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Telephony.

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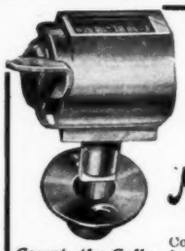

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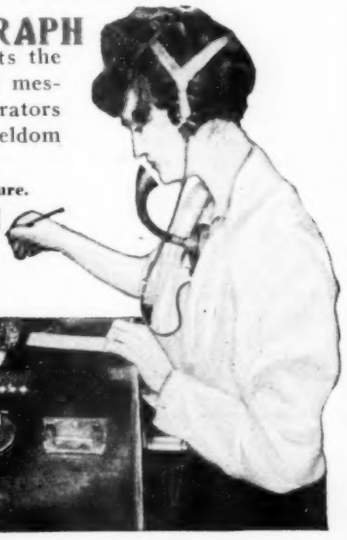

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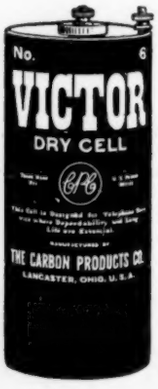

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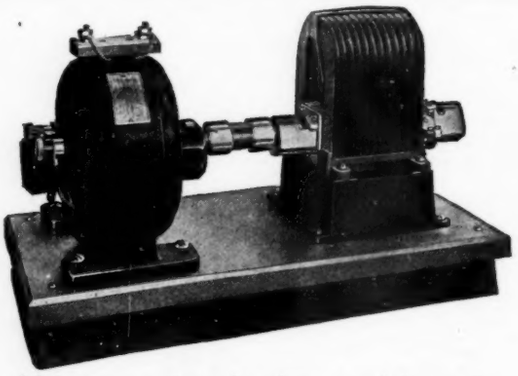

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THE AMERICAN TELEPHONE JOURNAL

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CURRENT OPINIONS AND COMMENTS

It is the testimony of the eye witness that carries conviction. The man on the job is given credit for knowing what he is talking about, and his opinions and beliefs carry weight, which is as it should be.

Attention, therefore, should be called to a statement made by Chairman Lewis, of the Indiana Public Service Commission, when expressing his views of the utility situation. Two sentences which he uttered should be given strong emphasis by all public service corporations. They are:

"Two of the most vital needs of the country at this time are, first, confidence in public utility securities; second, substantial foundation for investors' confidence. Public utilities have undergone a strenuous four-year period, and they emerge from the distressing war era, the more strenuous post-war period and four years of increasing operating costs, in a condition that demands the closest and most careful attention."

* * * *

A member of a rate-making commission can speak of the needs of public utilities with the same authority that an engineer, a physician, or any other expert can rightly claim in commenting upon the work under their control. Chairman Lewis has not exaggerated the facts. The dependence of the people on utilities unfortunately is not fully appreciated until the utilities fall down, and to their credit it must be said that seldom happens.

Another thing which the public does not adequately understand, also, is the dependence of the utilities on sufficient revenue to enable them to obtain the capital necessary to furnish the service the public requires.

The most efficient and progressive of the rate-making bodies, however, are realizing this necessity and admit that utilities must be permitted to earn enough to induce capital to enter that field, thereby enabling telephone, gas, electric and street railway companies to make extensions and give good service.

Capital is just as essential a requirement for these utilities as are telephone apparatus, gas mains, power houses and street cars, and the financial records show that the expense of securing capital has increased the same as other commodities.

* * * *

No doubt this situation was a factor in leading the Bell organization to place its stock on a 9 per cent basis. Many industrial concerns which have won marked success have found it advisable within recent months to float securities at an 8 per cent rate which formerly sold readily on a 5 per cent basis. Taking into account interest, legal fees, commissions and other expenses, such a loan can easily cost the borrower 9 or 10 per cent.

So far as utility corporations are concerned, these facts point directly towards higher service rates. State regulation of utilities primarily means a fair deal to all—the service company as well as the public—and it is clearly the duty of the state to provide conditions that will invite investment in utilities and enable them to operate on a self-sustaining basis. In no other way can a fair deal be assured the other party—the public—for in no other way can satisfactory service be obtained.

* * * *

An important duty in this connection is to impress upon the general public how little all public service rates have advanced in comparison with the increased costs in every other field.

This is especially vital right now when some prices are going down. The utilities, with absolute justice, can still claim they need additional revenue in order properly to serve their patrons.

* * * *

A striking illustration of the fairness of this proposition is found in the report of the legislative committee which investigated the California Railroad Commission on allegations that it had been too liberal in granting utilities higher rates. The committee endorsed the rate increases, declaring they were inevitable and that they were, moreover, kept down to the lowest level consistent with reasonable service.

In addition, the committee found that while labor and other commodities which the utilities had to buy increased in cost from 60 to 180 per cent (and the cost of living generally 96 per cent), the rates of the utilities increased during the same period a maximum of only 36 per cent. The net revenues of the utilities increased

only 10 per cent while their operating expenses advanced 61 per cent.

With such figures as these staring them in the face, there is small wonder that the investigating committee upheld the action of the commission. They also clearly indicate that a very skimpy justice has been done the service corporations in the past, and that common fairness requires that they be treated more liberally in the future. This is particularly true of telephone companies in California that have rate applications on the docket for settlement later in the year.

* * * *

Many telephone men hesitate to ask for the rate increases they know they deserve because some other prices are falling, and they fear hostile criticism. They should read the official order issued by the Indiana commission granting a telephone rate increase at Gary which covered the point effectively.

"It is contended," said the order, "that in times of business depression a public utility should be required to forego its profits and take its losses like a private corporation. This might be all right if, during hard times, a public utility were permitted to close its doors and suspend operations until business conditions became promising. It might be still more logical if the utility were permitted during boom times to enjoy large earnings and pay out its profits in dividends."

Of course, the utility cannot take this course and so dodge hard times. It has to stick on the job and serve the public, in both fair and foul weather, for compensation fixed by regulation. The commission sensibly said it had no choice under the law but to grant the increase.

* * * *

Managers of companies with rural lines might profit by acting on the suggestion of H. P. Curfman made in his paper read before the North Dakota telephone convention. He advocated making a charge (say, 10 cents) against non-subscribers using a rural line.

"Why should we give a non-subscriber the use of our rural lines without any charge?" he asked with good reason. "We are giving away too much free service in our exchanges to non-subscribers. I have been charging 10 cents on my rural lines to non-subscribers for about six months. And in this time I have installed three telephones that I would not have installed if these parties could have talked out on rural lines without expense.

"You will be surprised at the end of the year, when you close your books, to note how much revenue you have made on such calls."

* * * *

This is one way the manager of a smaller exchange can increase his receipts and also develop new business. Free service is too cheap. It isn't appreciated. When a man pays for something, he values it more highly.

Simplifying Material Accounting

An Effectual Means of Recording Material Transactions Is Very Often a Problem— Practical Suggestions, Applicable to All Utilities, for Obtaining Necessary Results with Minimum Effort—Eliminate Details of Small Value Items

By Wm. M. Boyd

An effectual means of recording material transactions is a problem for many telephone companies, particularly the smaller ones. The many items making up the average material stock of a telephone company and the daily use of a great variety of material has forced many companies to maintain voluminous records.

In the past a detailed record of material was kept as a check on the supplies. When inventories of supplies were made, the count was compared with the material record and the inventory adjustment was thus determined. Demands for information as to unit costs, property additions, maintenance expense and appraisals for rate cases have been more frequent during the past several years and recourse to the material records has been necessary. The companies possessing records that were inadequate have undoubtedly had to work under a handicap.

Many companies have believed it necessary to keep a detailed record of each individual item of material. The elaborate scheme of material accounting, with full details for each individual item, means a considerable expenditure for clerk hire, and the results usually obtained do not as a rule justify the cost. In many instances too much attention has been given to the small, less expensive items of material, with the result that the details have become involved and some of the larger or greater value items overlooked.

The larger number of items and consequent details, together with the results obtained, may have influenced some of the companies to practically abandon their material records.

There is, I believe, a happy medium, a scheme whereby the necessary results may be obtained with the minimum effort. A record of supplies can be provided, which if properly maintained, will provide an adequate record of material used and also reduce the "charge off" for inventory loss to a minimum. The cost of properly maintaining such a record is so slight as to surprise the more skeptical.

The suggestions here made are applicable to all utilities and were adopted and used successfully at both large and small telephone exchanges.

I have in mind the experience of a large company having over 100,000 stations at approximately 50 exchanges. The scheme of accounting in use for some time was the same for all of the exchanges, both large and small. A detailed material record was kept, for each exchange, of *each item* of material purchased. The daily disbursements were summarized, and monthly each item of material was priced at actual cost. Inventories were made at intervals of four months.

An examination of a number of the material records disclosed the fact that more than 80 per cent of the money value of the supplies was represented in less than 20 per cent of the items of material, thus the balance of the items of material —the items of smaller value—represented 80 per cent of the ledger accounts but only 20 per cent of the total value of all of the material. Obviously the bulk of the material accounting was devoted to the items of lesser value.

The absurdity of exercising as much care in the accounting for a paper sleeve, a washer, a nail or other small value item, representing but 20 per cent of the total value of supplies but requiring 80 per cent of cost of keeping the material records, as was given to a piece of 900-pair cable, a pole, a coil of wire, subscriber sets or other items of greater value, was apparent. Efforts were immediately made to install a system of accounting that would provide an equitable apportionment of the accounting expense between major and minor items of ma-

terial, the value of the item largely governing its distribution to either class.

In addition, an effective means of eliminating differences between the records of material and the inventory count was sought, it having been found difficult to secure from the field forces satisfactory explanations of inventory differences, due largely to the lapse of time between inventories and the large number of items involved.

The first step was to segregate the items of material for which detail material records were being kept. These represented the 20 per cent of the items referred to as major items and consisted of poles, wire, cable, subscriber sets, etc., by classes and kind. An individual ledger page of the material record was assigned to each major item upon which was recorded the quantities of material received, the unit cost, and also the quantities of material disbursed during the month, and the unit price used which, for these items, was the cost price.

No detailed material record was maintained for the minor items, the price at which they were disbursed being the current price at the time of pricing. The minor items forming such a small portion of the value of the supply on account as a whole, the effect of price fluctuations was but slight.

Provision was made for a monthly inventory of the items of greater value—the major item—which was compared with the quantities reflected on the material ledger. Such differences as existed were referred to the storekeeper for explanation. It was found that these differences in most instances could be readily explained. The elapsed time between inventories was slight and the items involved few.

In this respect, it was surprising how accurately the average storekeeper, plant man, or manager could account for the disposition of these large items of material. I have talked with plant men who could tell where every pole had been set or removed for a year past. The use of the major items of material will stand out in their memory. They can refer to the work orders or record of jobs and readily check the material used.

It was found that the shortages were largely due to failure to report material when used. This is a fault that companies must overcome. Material used must be accurately reported. Experience has proved that the storekeeper will exercise greater care if asked to report on differences monthly and, in addition, is in a better position to adjust such differences as exist. It is also certain that with the reduction in the number of items to be inventoried, the expense of making the inventory will be less and the count made with more care than if the entire stock were counted.

The items of small value were inventoried annually and priced at current prices. The inventory of the major items, as of the same date as for the minor items, was priced at cost, and the total of the two inventories formed the basis of the inventory adjustment. It was found that the adjustment to be made annually was small, which was not unexpected, in that the major items representing more than 80 per cent of the value of all the supplies, had been adjusted each month.

The advantages derived were:

1. The knowledge that the principal items of material had been accounted for correctly. The "supply adjustment" was reduced.

2. The cost of making inventories of the principal items monthly, and the minor items annually, was less than the cost of making a complete inventory every four months, as had been the custom.

3. Clerical labor and stationery used for this purpose were reduced 80 per cent, as the number of items for which detailed record was kept was reduced to this extent.

A fact to bear in mind, and sometimes not properly appreciated, is that a scheme of accounting is not self-propelling—not like a motor or an engine—but is something that must not only be started off right but watched and supervised, and never reaches the point where one can afford to relax.

Another plan, which has been used successfully and provides a means of still further eliminating the detail accounting for minor items of material, is as follows:

From past performance, the use of minor items of material is determined—that is, whether for maintenance, construction, etc. The proportion applicable to *other than construction* is immediately charged out to the final account on the basis of past performance. The percentage relation of minor items to major items of material used for construction only is established and, as major items of material are used for construction, this percentage is added to cover the minor items of material.

The entire purchase of material should be charged to "material and supplies" and the proportion chargeable to "maintenance" or other accounts, except "construction" should be credited to "material and supplies" and charged to the appropriate account. The purpose of this action is that storeroom and cost-of-handling expense may be properly applied.

The following example may better serve to illustrate the working of this plan—

Past Performance.

Materials used entire year		$10,000
Major items	$8,000.00	
Minor items	2,000.00	
Detail of Major Items:		
Construction, pole line		$ 2,000
Construction, other classes of plant		6,000
Total major items of material used		$ 8,000
Detail of Minor Items:		
Construction, pole line		$ 400
Aerial cable		200
Aerial wire		100
Underground, conduit		150
Underground, cable		150
Central office equipment		200
Substation equipment		200
		$ 1,400
Minor items maintenance (by accounts)		600
Total minor items of material used		$ 2,000

Percentage of minor items of material used for maintenance: 600/2,000=30 per cent.

Percentage relation of minor items of pole line construction material to major items: 400/2,000=20 per cent.

Application of the Plan.

Material purchased, January, 1921.		$1,000
Major items	$800	
Minor items	200	
Minor items immediately charged to maintenance expense by accounts, 30 per cent of $200		60
Major items of pole line material used	$400	
Add for minor items 20 per cent	80	
		480

For the purpose of this example, pole line account was selected, not that it affords a better example of the working of the plan, but it was believed that one class of plant would serve to illustrate the plan.

The journal entries necessary to complete the foregoing transaction would reflect the following detail:

	Dr.	Cr.
122: Materials and supplies (major items $800) (minor items $200)	$1,000	
Accounts payable		$1,000
Maintenance accounts (30 per cent of $200)	60	
Construction pole lines (major items $400) (minor items, 20 per cent, $80)	480	
Materials and supplies		$ 560

Too much emphasis cannot be laid upon the fact that "material" accounting is a factor in the success of your company.

A Guiding Thread.

He who every morning plans the transactions of the day and follows out that plan, carries a thread that will guide him through the labyrinth of the most busy life. The orderly arrangement of his time is like a ray of light which darts itself through all his occupations.

But where no plan is laid, where the disposal of time is surrendered merely to the chance of incidents, chaos will soon reign.—Victor Hugo.

Keep a record of your material—and know how it has been used, whether as an addition to your plant, in replacement, or for maintenance. Don't "charge out" your material on some arbitrary basis or by guess. Don't load yourself with so much detail that in accounting for all the screws and nails, etc., you lose sight of a pole, a coil of wire, or some other major item of plant.

Some of the companies which have not been as successful in their application for rate increases as they have felt they should have been, would have fared better if they could have said:

"Here is the correct record of my plant additions and displacements, all of the material purchased has been accounted for monthly, that used on construction is charged to construction, and that portion to expense is in my expense statements. There is no guesswork, the records are open to your engineers and accountants to check."

Program of Florida Telephone Convention Next Week.

Arrangements for holding the 14th annual convention of the Florida Telephone Association at the Chamber of Commerce Bldg., Jacksonville, on Tuesday, April 19, have been completed. The program in full is as follows:

Address of Welcome, John W. Martin, mayor of Jacksonville.

Response to Address of Welcome, W. G. Brorein, president, Florida Telephone Association.

Address, Dr. W. L. Moor, Tallahassee, secretary, Florida Telephone Association.

Address, R. Hudson, Burr, chairman, Florida Railroad Commission.

Discussion of Seasonal Rates for Florida, opened by W. F. Webster, Miami.

Discussion on Provision for Depreciation Reserve, opened by A. B. Stewart, Tampa, Peninsular Telephone Co.

Governmental Departments Act for Communications Unity.

Organization of a permanent interdepartmental committee on communications will be recommended to President Harding as a result of a conference held last week by representatives of five departments. Should the organization be authorized, it is understood that at the next meeting a proposal will be advanced to consolidate all government communication activities in Washington in a sort of clearing house, as the first step toward creation of a Department of Communications.

The purpose of last week's conference, at which the State, War, Navy, Commerce and Post Office departments were represented, with Under-Secretary Fletcher presiding, was to discuss the formulation of a general communications policy, particularly as applied to radio communication.

Nearly every executive department now maintains independent telegraph and telephone lines, government-owned, to New York and other cities, and several departments have more or less extensive radio organizations, of which the Navy department's is the largest.

All the departments have maintained extensive switchboards and telephone systems in Washington, and those of the War and Navy departments were recently consolidated, resulting in a saving of about $100,000 a year. It was said last week that a saving of thousands of dollars annually would be effected if all the telephone, telegraph and radio needs of the various departments were consolidated.

For the present, the plan would only be applied to domestic messages, it is understood.

Cuba Connected by Telephone Cable

Telephonic Communication Established Between United States and Island of Cuba by Means of Submarine Cables Between Key West, Florida, and Havana, Distance of Approximately 100 Miles—Details of Formal Opening

Formal opening of telephone communication between the United States and Cuba took place at the Pan-American Union Building, Washington, D. C., on April 11, under the auspices of the National Press Club.

As an incident to the formalities, the conversation was also arranged between Catalina Island, in the Pacific ocean, with Havana—the record in miles for a spoken conversation over a communication of wireless, land lines, and deep sea cable.

President Harding, Secretary Hughes, Secretary Mellon, the Cuban Minister to the United States, Cuno H. Rudolph, President of the Board of Commissioners of the District, and Col. John J. Carty participated in the ceremony.

Each person was given a telephone, so that practically a thousand in Washington heard the greetings between President Harding and President Menocal of Cuba, and the talk from the Pacific to the Atlantic. A similar party was held at the Havana end of the line, where President Menocal was host to a brilliant gathering. The members of the Cuban party heard every word of the Catalina-to-Havana conversation.

A dramatic feature was a "roll call" of cities by telephone, beginning with Havana and ending with the wireless telephone operator at Catalina island, who sent his answer through space to Los Angeles and thence by wire and cable.

Beginning with "Hello, Havana," Col. Carty called for and received an answer from telephone officials stationed at 26 cities across the continent, including Chicago, Washington, Philadelphia, Harrisburg, Pittsburgh, Denver, San Francisco, and Los Angeles. As with the other features, every one in the audiences, in both Havana and Washington heard the roll call.

The route which the cables take from Key West, Fla., to Havana, Cuba, is approximately 100 miles, a greater distance than ever before attempted for submarine telephone communication.

As the water between Key West and Havana is 6,000 feet deep in places, a considerably greater depth than any at which a telephone cable has ever been laid, the engineers agreed that the compression strain would be too great for the usual type of cable. In meeting this difficulty, a type was adopted which never had been used for a longer distance than 40 nautical miles, that particular record being held by the cable from Dunkirk to St. Margarets, laid in an emergency by the British government in the early days of the World War.

The metallic return also was abandoned, and the cables will be grounded at sea, a procedure which might be startling to some engineers, but which was considered advisable in the interests of good service under the peculiar set of circumstances encountered.

The temperature of the tropical waters and the speed of the current that runs around the most southern point of the United States were other elements which had to be considered by the engineers in selecting a set of specifications for the cables. And then came the toredo, a small but dangerous enemy, a boring insect of the sea, which eats through cable armor, insulation and a great variety of other substances. The habits and appetite of the toredo played an important part and added considerably to the cost of constructing the cables.

To make repairs easier and to minimize the dangers of totally interrupted service, it was determined to lay three cables instead of one large one, although water compression constituted additional evidence against a multiple-core cable. As a further protection to continuous service, the cables lie five miles apart.

Multiplex Telegraphy—Telephony

The Development of Carrier Current Telephony — Fundamental Principles Underlying Development — Commercial Apparatus and Actual Installations — Paper Presented Before American Institute of Electrical Engineers

By E. H. Colpitts and O. B. Blackwell

The carrier method of multiplexing telephone and telegraph lines is technically one of the most interesting and important of the developments which have been perfected in the art of electrical communications during the past few years. In this paper we are giving a brief sketch of the development of this art, an explanation of the principles on which it is based, and a description of the applications which have been made in the plant of the Bell telephone system.

In a carrier multiplex system, a number of separate telephone, telegraph or signaling messages are superimposed simultaneously on a single electrical circuit by employing a separate alternating current, usually called a "carrier current," for each of the separate messages. This carrier current is made to vary in accordance with the variations of current representing the telephone, telegraph or signaling message. The different carrier frequencies which are superimposed on a circuit must differ sufficiently in frequency so that they may be separated from each other at the terminals by the use of proper electrical circuits.

Each carrier may be of either audible or ultra-audible frequency, but its frequency must be higher than the highest frequency represented in the message to which it corresponds. These currents are known as carriers, since in a sense, they may be said to "carry" the telephone, telegraph or signaling currents by which they are controlled.

The underlying principles of such systems are old in the communication art and indeed go back to the date of the inven-

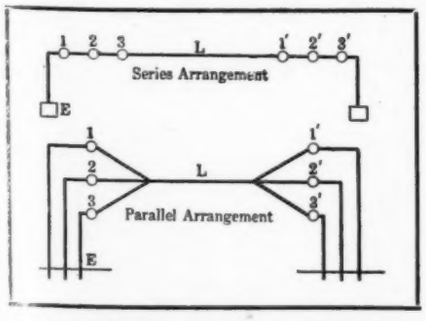

Fig. 1. Multiple Harmonic Telegraphy.

tion of the telephone itself, for it will be recalled that it was Bell's experiments with the vibrating reed type of multiplex telegraph system which led to his discovery of the telephone. A short history of the art during the 40 odd years that have elapsed between the conception of its possibilities by the early communication pioneers and the present realization of their hopes is given under the heading "Historical."

In looking back over the early history of the carrier art it is now clear that the development of successful multiplex carrier systems had necessarily to await not only the evolution of the fundamental ideas for carrier operation, but also the development of radically new types of apparatus and the developments in electrical wave transmission over wires which have characterized the recent progress of long distance telephony.

The telephone and telegraph systems which are described in this paper are in daily use over long toll circuits in the Bell telephone system. The telephone installations in service furnish simultaneously as many as four two-way telephone conversations over each circuit in addition to the telephone and telegraph facilities normally afforded by the circuit. The telegraph systems in service are arranged to furnish as many as ten duplex carrier telegraph circuits over each circuit in addition to the telephone and telegraph facilities normally afforded by the circuit.

These figures do not indicate the maximum numbers of facilities which it will be found economical to employ ultimately, but cover the facilities furnished by the systems which are now commercially employed. The increased circuit facilities obtained in this way are, in general, up to the high standards set for the best grade of long-distance circuits. They are relatively stable and are maintained by the regular telephone plant personnel.

The carrier circuits, both telephone and telegraph, are so designed that as circuits they fit in completely with the more usual circuit facilities of the telephone system. They may be connected with each other and with ordinary circuits, and, in general, present much the same degree of practicability and flexibility of operation as do the more usual forms of circuits.

While the development has thus succeeded in making available to the communication art new types of circuit facilities, these facilities can only be made to meet the high standards required in a public service plant by the use of correspondingly high grade equipment which, unfortunately, is correspondingly expensive. Indeed, the cost of these systems, at least at present, is such as to make their use economical only over relatively long toll circuits. For short distance toll service, and for local exchange service, the equivalent facilities can be provided more cheaply by the older methods.

Historical.

As indicated in the preceding, the multiplex carrier art had its origin in the harmonic telegraph systems dating back to the time of the invention of the telephone

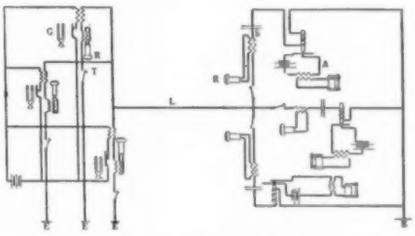

Fig. 2. Pupin's Original System (1892) Using Electrical Resonance for Selecting Carrier Frequencies.

itself. With such alternating current telegraph systems are associated the names of Gray, Bell, Van Rysselberghe, Edison and Mercadier. The multiplex feature of these systems is well illustrated by Fig. 1, which is a reproduction of a diagram of Elisha Gray's system published[1] in 1886.

In this figure, the circles numbered 1, 2 and 3 represent vibrating reed transmitting instruments while those numbered 1', 2' and 3' represent the corresponding receiving electromagnetic reeds. When one of the transmitting reeds is vibrated, the electrical waves sent out set into oscillation the correspondingly tuned receiving reed which thus gives out an audible note.

The systems invented by these pioneers are all characterized by the use of the mechanical resonance of tuned reed instruments for generating and selecting the carrier frequencies involved. This type of system has been more fully developed by Mercadier.

Shortly after 1890 there occurred the next outstanding development in this art, namely, the use of electrical resonance instead of mechanical resonance for selecting the carrier frequencies. An interesting piece of technical history is disclosed in the manner in which several investigators, Professor Pupin, Hutin and Leblanc, and John Stone Stone, independently invented about the same time the electrical method of selection of a plurality of carrier frequencies. Pupin was adjudged the earliest inventor in the United States. His original system is illustrated in simplified form in Fig. 2.[2]

[1] Leblanc, M., "Le Telephone Multiplex," La Lumiere Electrique, p. 97, Apr. 17, 1886.

[2] From U. S. Patent No. 707,007, 1902.

In order to permit the successive figures in this historical discussion to be readily followed, a uniform system of lettering their important parts has been employed. These conventions are as follows:

G = Generator of carrier current.
T = Telegraph key, telephone transmitter or other carrier modulating-device.
L = Line.
S = Selecting or tuned circuit.
D = Detector.
A = Amplifier.
R = Receiver.
DR = Detecting receiver.
E = Earth.

By following this lettering, Fig. 2 will be readily understood. It will be noted that at each end the line branches into three parts, and that each circuit is tuned by capacity and inductance to a particular frequency. It will be seen, furthermore, that each of the channels derived in this manner is arranged for sending in both directions, although not simultaneously.

Each generator consists of a self-excited tuning fork driving a contact or a microphone transmitter. Receiving is accomplished, either by a telephone receiver or by a vibrating reed device which is operated by a microphone amplifier.

Pupin also invented an electrolytic detector for use in such alternating current telegraph systems as shown in Fig. 3.[3]

The function of this detector was to rectify the alternating current and thus enable a direct current telegraph relay to be operated from the rectified current. This marked the beginning of the use of separate devices for performing the two primary functions of carrier receiving: (1) that of reproducing from the carrier the current variations which represent the original signals; and (2) that of indicating the signals, as by a relay or telephone receiver.

The separation of these two functions is important in the carrier art because it permits the place at which detection is effected to be separated from that at which the indication or interpretation occurs.

While the contributions up to this time were concerned primarily with telegraphy, they were very soon carried over into the field of telephony (still in the early 90's) by such pioneers as Gibboney, Hutin and

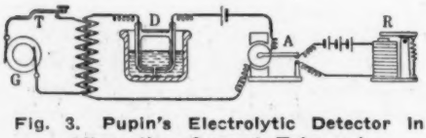

Fig. 3. Pupin's Electrolytic Detector in Alternating Current Telegraph System (1898).

Leblanc, and Stone. Their predecessors were concerned with the use of carrier frequencies of the order of a few hundred cycles, whereas, these inventors appreciated the necessity of employing for telephony carrier currents sufficiently high in frequency to preserve the characteristics of the voice currents.

Thus we find suggested at this early date the use of carrier currents in the tens of thousands of cycles, which values

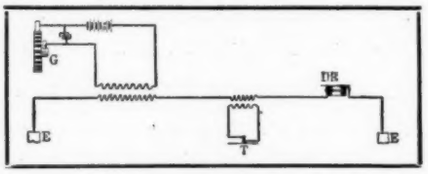

Fig. 4. Hutin and Leblanc's Carrier Telephone System (1892).

have since proved to be in the preferred frequency range. Hutin and Leblanc so simply illustrated the use of relatively high-frequency alternating currents for telephony that it is useful to reproduce their early diagram as shown in Fig. 4,[4] for the purpose of obtaining in our discussion an appreciation of the principles involved.

This is a carrier telephone circuit of the simplest type, arranged for a single one-way transmission. Connected in the line are three elements—the generator of the high-frequency currents G, the voice actuated modulator T, and the detector-receiver DR. The generator is a high-frequency commutator; the modulator is a microphone transmitter; and the receiver, which is of the dynamometer type, serves the double function of detection and of translation into sound waves.

Multiplex operation of this type of carrier telephone channel as devised by these French inventors at the same time (about 1892) is also representative of these early contributions to carrier telephony and is reproduced in Fig. 5.[5] Here we have the carrier telephone channel of Fig. 4, arranged for multiplex operation by the use of electrical selection, each of the carrier circuits being tuned by capacity and inductance to its own carrier frequency.

As indicated, the carrier currents of all the channels are introduced into the line at a common point through a transformer. At each terminal the line divides into four branches. Each sending branch contains a microphone transmitter T connected into circuit through a transformer. Each receiving branch contains a dynamometer receiver DR. The condenser in each transmitting circuit and the inductance in each receiving circuit were employed in tuning the channels.

The multiplex system invented by John Stone Stone[6] was very similar to those illustrated for Pupin, and Hutin and Leblanc, and is, therefore, not illustrated. It did, however, contain an important improvement over those of his contemporaries in that he tuned the local branch circuit individually instead of tuning the system from end to end for each carrier channel, as did Pupin, and Hutin and Leblanc (see their figures). This improvement is evident also in a system which he developed shortly afterward, especially for high-frequency transmission. This is illustrated in Fig. 6.[7]

Stone devised and tested this system in the laboratories of the American Bell Telephone Co. in 1894. The high-frequency currents were generated by means of small arcs which were fed from a direct current source through a suitable choke coil. One of the electrodes of each arc in Fig. 6 was made light in weight and was attached to a diaphragm which served, when acted upon by voice air waves, to modulate the high-frequency currents generated by the arc.

The particular arrangement illustrated is also of interest in showing the tuned circuits at both the sending and receiving ends as associated with the line in a series manner, an arrangement which is an alternative of the parallel connections previously illustrated.

It is also of interest to note in connection with these older multiplex telegraph

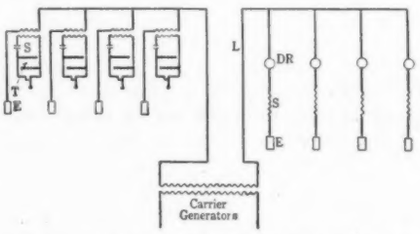

Fig. 5. Hutin and Leblanc's Carrier Telephone Channel Arranged for Multiplex Operation (1892).

systems that Van Rysselberghe recognized as early as 1886[8] the advantage of superimposing the alternating current circuits on an ordinary direct current telegraph circuit, thereby enabling the ordinary telegraph wires to be employed for the transmission of the multiplex system.

While the idea of extending the range of frequencies employed in the multiplex system down to zero frequency and thereby including the direct current signaling circuit would naturally be obvious in a more advanced stage of the art, its invention at this early date illustrates the clear engineering appreciation these earlier inventors possessed.

It will be seen, therefore, that the foundation of the carrier art was laid back in the 1890's, at which time there had been contributed these cardinal features:

1. Electrical selection or tuning.
2. The use of continuously generated high-frequency carrier currents.
3. Modulation of the carrier, as by a microphone transmitter.
4. Detection and indication of the high-frequency currents by means responsive continuously and proportionally to the received current.

[3] From U. S. Patent No. 713,044, 1902.
[4] From U. S. Patent No. 596,017, 1897, British Patent No. 23,892, 1892, French Patent No. 215,902, 1891.
[5] British Patent No. 23,982, 1892; French Patent No. 215,901, 1891.
[6] U. S. Patents Nos. 726,368, 1903; 726,476, 1903; 729,103, 1903; 729,104, 1903.
[7] From U. S. Patent No. 638,152, 1899.

Relations of Radio Developments.

With the entrance of wireless telegraphy into the communication field, the attention of those scientists and engineers who might otherwise have developed the art of wire multiplex, so well begun, as indicated above, seems to have been diverted to the new found art.

The Art of the 90's.

The wireless art started with the use of very high frequencies, generated discontinuously by the spark method, and gradually came to use waves of lower and lower frequency, and of increasing persistency. Finally, with the use of continuously generated waves, the radio frequency range came to overlap the frequency range earlier employed in high frequency wire transmission.

The wire carrier art started with the use of audible frequencies and extended into the ultra-audible range, where it was later met by the radio frequencies.

The similarity of the history of the two developments is illustrated by the fact that the major steps, which are noted above for the early carrier art, also mark the major steps of advancement of the radio art. By reading over the four points above, keeping radio in mind, the parallel will be seen to be quite complete.

These ideas of continuous wave telephone transmission were quite thoroughly appreciated in the radio art by about 1905, although they have not been fully attained in practice until quite recently. It was natural that radio engineers should carry these ideas over to wires, using radio instrumentalities which, while different in form, operated on the same principles as did the means employed by the earlier wire pioneers.

Simultaneously with this evolution of the radio art, attention continued to be given to the older wire carrier transmission by such other investigators as Vreeland in America and Bela Gati and Maior in Europe. About 1906 Vreeland, using his well-known mercury-vapor oscillator as a generator of sinusoidal carrier currents, devised a multiplex carrier telegraph system which embodied improvements in the use of loosely coupled tuned circuits in proper relation to the impedance of the line.

An engineering and commercial development of this period, as distinguished

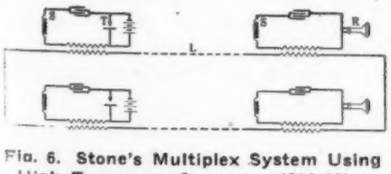

Fig. 6. Stone's Multiplex System Using High Frequency Currents (1894-96).

from more purely laboratory or theoretical investigations, was the so-called "Phantoplex" system devised by engineers of the Postal Telegraph Co. and quite extensively employed by that company. In this system a relatively low-frequency carrier telegraph channel was superposed on the ordinary direct current circuit. In addition to the above, attention may be called to the disclosures by Ehret and Kitsee. Ehret shows[9] a multiplex carrier

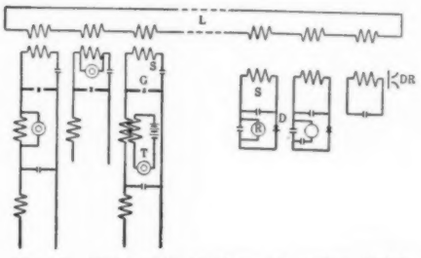

Fig. 7. Ruhmer's System of Using High Frequency Wire Transmission (1909-10).

telephone system including amplifiers, and Kitsee shows[10] a carrier telegraph channel operating over an ordinary telephone circuit.

Previous to 1910, Dr. Ruhmer in Europe had undertaken experiments on high-frequency wire transmission, employing apparatus taken from the then current radio art. Ruhmer's system[11] is illustrated in Fig. 7.

He employed oscillating arcs as high frequency generators, microphone transmitters as modulators, tuning at both the transmitting and receiving ends, and a radio detector in the receiving circuit.

In 1910 and 1911 Major, now Major General, Squier carried out a set of experiments employing a carrier channel operating over a short telephone cable circuit. The announcement of his work popularized interest in this art, and the paper which he presented before the Institute in May, 1911, brought out considerable discussion.

The system which he used in his experiments is illustrated by Fig. 8.[12] This shows a carrier telephone channel operating over the wires of an ordinary telephone service. A high-frequency alternator is employed to generate the carrier current, a microphone transmitter is used as a modulator, tuning is employed at the sending and receiving ends, and a radio detector is employed in the receiving circuit.

As a part of the evolution of the radio art, there was developed in its early and somewhat crude form a device which was destined to play an extremely important part, not only in radio, but in wire communication as well—that is, the thermionic tube. Originally invented by Edison, this device was first applied as a radio detector by Fleming about 1904. DeForest in 1906 made a vital contribution by adding the grid, and thereby laid the foundation for its use as an amplifier. The history of this very remarkable device is so well covered in recent technical literature that we will discuss it here only in connection with its specific application to the carrier art.

The preceding history brings us up to about 1912. About this time an important step was taken toward the adaptation of the vacuum tube as a non-distorting amplifier by the addition of a negative grid battery by Lowenstein.

Since this date, in addition to the active developments which were carried out in the Bell system and are described below, certain other investigators have been working in this field, among whom may be mentioned the General Electric Co., U. S. Signal Corp Engineers, Lee DeForest and certain European investigators, especially in Germany and France. In the attached bibliography will be found references to the more important publications which have been made by such investigators.

Bell System Developments.

The most important developments, which have occurred since 1912 and are principally the work of the research and development departments of the Bell system, may be stated as follows:

1. Development of the thermionic vacuum tube into a reliable and stable instrument for amplification, modulation and demodulation.

2. Development of the electrical filter and an improved technique of separating electrical currents of different frequencies.

3. Development of the technique of transmission over wires, particularly in connection with repeater operation and of methods of overcoming interference between circuits.

4. Development and operation of commercial carrier systems.

In considering these developments which have led to commercial operation, it should be appreciated that in order for a carrier system to be commercially successful, it must compete on equal terms with the ordinary types of wire circuits—that is, it must have the same degree of reliability and stability, and must give the same degree of privacy and the same freedom from interference. Moreover, the system must be capable of being readily maintained and must be arranged so that

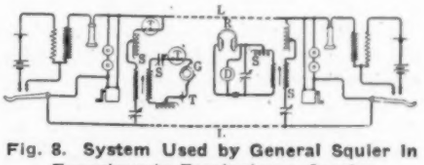

Fig. 8. System Used by General Squier in Experiments Employing a Carrier Channel (1910).

it may be used interchangeably in the ordinary manner with any of the facilities furnished by the plant. All of these conditions must be met at a cost less than that of the ordinary types of circuits for similar service.

[9] U. S. Patent No. 363,188, 1887.
[10] U. S. Patent No. 789,087, 1905.
[11] U. S. Patent No. 666,883, 1901.
Belgian Patent No. 224,008, Mar. 31, 1910; Zeitschrift fur Schwachstromtechnik of February, 1911; Electrical Review and Western Electrician, July 1, 1911.
[12] From Fig. 6 of Squier's A. I. E. E., 1911 paper. Also Fig. 1 of U. S. Patent No. 950,356, 1911.
[13] Gherardi and Jewett. A. I. E. E. Trans., pp. 1287-1345, 1919.

Developments in Thermionic Vacuum Tubes.

The development of the thermionic vacuum tube as an amplifying element in a telephone repeater has already been described before the Institute,[13] as has also its application to radio telephony.[14]

The success which attended these two lines of development indicated that in this one device was embodied the solutions of many of the controlling difficulties that had previously stood in the way of the commercial development of carrier systems. In connection with a resonant circuit, the vacuum tube provides a compact and reliable source of continuous oscillations of readily adjustable frequency.

As an amplifier of both low and high frequency currents, it removes the necessity for excessive line currents. As a modulator and demodulator, it provides an ideal means of impressing the voice waves on the carrier current, and of restoring them to their original form at the receiving end. These tubes have, moreover, been developed into devices which are very stable and reliable in operation, and may be maintained with only routine periodic supervision.

Electrical Filters.

Another development which has been of vital importance in the success of carrier telephone systems is that of the "band-filter" invented by G. A. Campbell.[15] Without such electrical filters, it would be impossible to utilize economically the relatively low frequency range employed in the present carrier telephone systems, or to separate various channels in this range from each other or from the ordinary telephone and telegraph channels.

The simple tuned circuits of the prior art would either introduce prohibitive distortion or, if made sufficiently non-selective to avoid distortion, would require placing the carrier channels widely apart in frequency. The Campbell filter, therefore, enabled the carrier channels to be squeezed closely together at comparatively low frequencies where the difficulties of transmission over lines is at a minimum.

Transmission Over Wire Circuits.

Since the attenuation over wire circuits is much greater at carrier frequencies than at the ordinary telephone frequencies, tems is particularly dependent on the use of repeaters at comparatively frequent intervals in the line. This has required the development of high-frequency repeaters involving the application at high frequen- the successful operation of carrier sys-

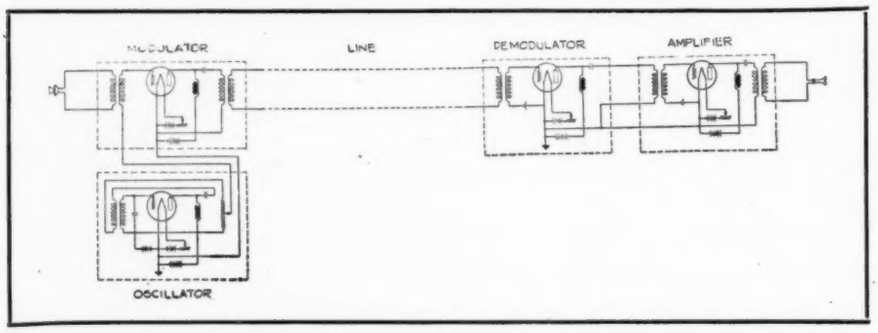

Fig. 9. Circuits Involved in a Single One-Way Carrier Telephone Transmission Channel.

cies of all the developments of the repeater art which were described before the Institute in the paper on telephone repeaters already referred to.

As in the case of telephone repeaters at voice frequencies, the amount of amplification which can be given by each repeater depends entirely on line conditions, such as the degree of line balance which can be maintained at the repeater point and the degree to which mutual interference between line circuits can be prevented.

This prevention of interference between line circuits required the development of more elaborate methods of transposing and adjusting them. In order to overcome the large transmission losses and irregularities introduced in open-wire lines by unavoidable sections of cable, new types of loading for cable circuits were developed for these carrier frequencies and put into practical use.

In 1914, simple forms of carrier circuits, embodying the fundamentals of our present system, were successfully set up in the laboratory, and experiments carried out with them. In view of the favorable conditions which had resulted from the various developments previously noted, it was decided to begin active work toward commercial carrier systems.

Development and Operation of Commercial Carrier Systems.

Field measuring apparatus was developed with which the characteristics of existing telephone lines were carefully studied in the carrier-frequency range. At the same time in the laboratory the physical possibilities and limitations of the various types of apparatus and circuits were being studied. Based on these fundamental data there was developed in the laboratory a complete multiplex telephone system providing two-way telephone conversations, and operating over an artificial line.

[14] Craft and Colpitts, A. I. E. E. Trans., pp. 305-343, 1919.
[15] U. S. Patents Nos. 1,227,113, 1,227,114, of 1917.

This laboratory apparatus was then taken into the field and tried out on a line between South Bend, Ind., and Toledo, Ohio. The practical difficulties always encountered were overcome, and satisfactory operation secured. At the same time satisfactory results were obtained on a simple type of carrier telegraph system between Chicago and Toledo.

The entry of this country into the war brought the work to a standstill for a time. However, the same cause created a demand for more telephone circuits between Washington and Pittsburgh. It was decided to meet this demand by a trial installation of a carrier telephone system between Pittsburgh and Baltimore, from which point cable circuits to Washington were available.

In view of the urgency of the situation, the apparatus used in the earlier field experiments was adapted to equip the Pittsburgh terminal, while new apparatus was built for the Baltimore terminal. This carrier system went into service and has since been operating satisfactorily.

Principles of Operation.

An adequate understanding of carrier systems requires a consideration in some detail of the fundamental principles underlying their operation. Some of these principles, which are also important in connection with telephone repeater operation and in connection with radio telephony, have already been discussed at some length before the Institute in papers on those subjects as referred to above.

We will first discuss those features which are involved in a single one-way carrier telephone transmission channel, including generation of carrier current, modulation and demodulation or detection. Next will be considered multiplex operation in a single direction, involving separation of channels by selective circuits, followed by a consideration of two-way operation of single and multiplex channels.

Next will be presented an explanation of another type of system in which no unmodulated carrier current is transmitted over the line and of a special mode of carrier current generation particularly adapted to this system. Finally the repeaters used for amplifying the currents of carrier frequency at intermediate points, and certain other matters such as ringing and the assignment of carrier frequencies will be discussed.

Fig. 9 shows schematically the circuits involved in a single one-way channel. The source of carrier frequency shown is a vacuum tube "oscillator." The operation of oscillator circuits in their many forms has been so thoroughly covered in the recent technical literature as not to require detailed discussion here.

(To be continued)

A Strike of Telephone Subscribers

In Protest Against Increased Rates, 700 Subscribers of Bloomington, Neb., United and Cut Themselves Off from Service—Company "Standing Pat" and Strikers Determined—What Attorney General Told Them About Conspiracy

A situation unparalleled in Nebraska telephone history exists at Bloomfield, where 700 subscribers to the Union Telephone Co., all on that exchange, have voluntarily cut themselves off from service. It is a "hunger strike" aimed to force the company to forego the collection of increased rates authorized by the state railway commission, being about 22 per cent in excess of the old schedule, which had not been changed since before the war.

Company "Standing Pat."

At the present writing, the company is standing pat on its proposal that it must have living rates, and it is backed in this particular by the commission, which refused the request of a committee of bankers and business men to order a reduction in rates. Meanwhile the "strikers" are reported to be looking for some way in which to let go of the bear and at the same time save their faces.

The commission has offered to send one of its members to Bloomfield to explain fully the details of the company's affairs and the reasons why it was necessary to increase the rates, if assured that he would be given a respectful hearing at a mass meeting. Another proposal is to call in some officer or committee of the state telephone association to act as arbiter.

The commission has made it plain that it will not permit the company to reduce the rates, if it seeks that way out of the difficulty, because having invoked the law, the law must govern—and that prevents the collection of any rates other than those fixed by the commission. It has sent word to the company that it might be the part of wisdom to make the first step towards a conference with the patrons.

The members of a committee that called on the commission to ask it to handle the situation were told by the attorney general, after they had made a full statement of the affair, that the citizens, individually and collectively, had made themselves liable for any and all damages sustained by the company because, from their own declarations, all of the subscribers had acted in concert and that the law regards as a conspiracy.

From these statements, it appears that after the patrons had failed to make their protest against any increase in rates stick with the state commission at the usual hearing following the application for an increase, they held two indignation meetings. In each of these, the local commercial club was the moving spirit. It was unanimously voted to dispense with service at the same time, that being the night before the new rates were to go into effect, but here a difficulty arose. It would take weeks for the company to remove all of the instruments, and meanwhile those with service would have an advantage over the others.

In this emergency, a local electrician was consulted. He showed them that by loosening two screws the wire could be lifted out; that anybody could do this; and if they all did it at an agreed hour, they would all be cut off. This plan was carried out, and at the concerted time all service ended.

The Union company recently expended $30,000 in rebuilding the Bloomfield exchange, and supposed that with the improved service no objections would be made to an increase in rates. The commission had its own engineers value the property, and when the new schedule was authorized, stated that the company had an actual value of $13,000 more than was allowed as a basis for interest return, saying this should be held as a surplus.

E. H. Mason, banker, W. D. Funk, attorney, and other business men composed the committee that waited on the state railway commission. The members of that body took turns in pouring "hot shot" into the committeemen, and they were visibly agitated when the attorney general pointed out to them that, while individually they had the right to order their service discontinued. when they acted in concert and for the admitted purpose of forcing the company to do a specific thing, they laid themselves open to a civil action for damages.

They said that the farmers were set against any increase in telephone rates at a time when prices were coming down, and especially after they had suffered such tremendous cuts in the prices of farm products. When they were told that all the time they were getting war prices and the business men were reveling in profits, this company had had no increases in rates, they refused to recede from their position that the company ought to do business at a loss along with its patrons.

Banker Embarrassed on Interest Rates.

Mr. Mason spent some unhappy moments with the commission. When he admitted that he is getting higher interest rates now than before the war, the commissioners told him that the company was exactly in the same position as he was—that their rates were the last to go up and, in fairness, ought to be the last to go down. Commissioner Browne pointed out that the testimony showed that local bankers were carrying a $14,000 loan to the company at 10 per cent, the excess interest, under regulation, coming out of the patrons, and that a heavy stockholder had taken this up and is carrying it himself at 7 per cent.

Mr. Mason objected to the commission giving the company an 8 per cent return, and said that if he could be guaranteed that, he would be glad to be under the state railway commission—but withdrew the statement when he was told that regulation meant he should earn no more than that. He said he had not understood it that way.

State Tied Company's Hands.

Commissioner Taylor pointed out that while the farmers and business men, who are protesting that they will not pay the new rates, not because they cannot but because they don't want to, were making big profits, the state tied the hands of all telephone companies by keeping them down to normal returns as a maximum—and they now have no surplus upon which to draw.

The exchange at Bloomfield was once owned locally, but the stockholders never having been able to get a manager who would make it pay, had sold it to the Union company of Wausa, of which J. E. Baggstrom, one of the best telephone men in the state, is manager. Wausa is a rival town, and is headquarters for the company, which also has exchanges at Crofton and Magnet. Mr. Baggstrom is one of the directors of the state telephone association. Wealthy farmers in and about Wausa own the stock, and their investment totals over $100,000.

The commission found the rates asked for were not unreasonable, and raised them at all exchanges, charging Bloomfield more because the exchange there is all metallic.

The committee that called on the commission did not apparently challenge the facts found by that body or attack the reasonableness of the rates, but said the people did not want to pay them because they thought that with other prices coming down, telephone rates should not be raised, at least. The commission sought to find out if it was a bankers' fight over loans or the result of town rivalry, but found no evidence of either condition.

There was some resentment over the fact that the company did not consult with Bloomfield people over its improvements there in advance of making them, and also because a company man had told them that if they ordered their telephones out, it would cost them $3.50 to have them reinstalled.

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A Complete Presentation of the Principles Underlying Modern Telephony in All Its Branches—Arranged Systematically So That Regular Reading and Faithful Study Will Qualify Ambitious Men for Higher Positions—Prepared Under Supervision of Stanley R. Edwards—This Section Written by Jay G. Mitchell

Quiz Questions on the Preceding Installment.

1396. What method of mechanical circuit selection is used to the greatest extent? Name another method which is entitled to careful consideration. What determines the relative value of the two methods?

1397. What is the principal electrical method of driving switches for selecting telephone circuits? What mechanical combination is found in all electrically-driven switches making use of current impulses for the actuating magnet? Enunciate a few of the mechanical devices required for the operation of a wiper-carrying switch and their several functions. How is the matter of undue mechanical wear compensated in the conventional switch design? What is the usual operating speed of wiper-carrying switches? What is the maximum speed at which some single-motion switches are operated? What effect does the operation of the switch at the normal speed have upon adjustments made at lower operating speeds? What is the effect of the application of the switchman's expert knowledge in the adjustment of the switch?

1398. What is a desirable condition to attain in the type of relay shown in Fig. 113? What additional adjustment conditions are imposed when the number of relay contacts is greatly increased as in relays *C*, *F*, *G*, *L*, *M*, and *N* in Fig. 315? What is practically the sole point in such a relay at which adjustments are possible? What effect does the presence of 31 make contact springs have upon the reliability of operation of such a relay? When is this effect produced?

Chapter XXXIII.—Operating Combinations Including Switches (Continued).

1399. *Space requirements.*—In making a comparison between the operating results obtained by the use of wiper-carrying step-by-step switch mechanisms and those obtained by the use of relay equipment, it is necessary that the relative requirements as to space be considered as well as the other characteristics of each method.

The slightest consideration of the operation of the line-finder relay-selection equipment shown in Fig. 315 will show that ten of the 31-point multiple-contact relays, *L*, will be required for each subscriber's group of 100 lines. It is obvious that this number of relays of this type will extend farther in the vertical direction than would the conventional two-motion 100-point switch with its associate operating relays.

Other things being equal, therefore, it is true that the line-finder equipment which is operated on the principle of selecting the calling circuit by means of successive relay operation will require somewhat more head room than would be required for equipment serving the same number of subscribers' lines and provided with the conventional type of two-motion switch. In Fig. 315, only relays *L* and *N* are associated with the individual line-finder trunk equipment, the balance of the circuit as shown being more properly control equipment, one complete set of which is required for each group of line-finder trunks.

1400. *Speed of selection.*—In comparing the operation of the line-finder equipment conforming to the arrangement shown in Fig. 315 with the more common line-finder equipment in which step-by-step switches are used, it becomes apparent that one of the most marked advantages of the relay method of circuit

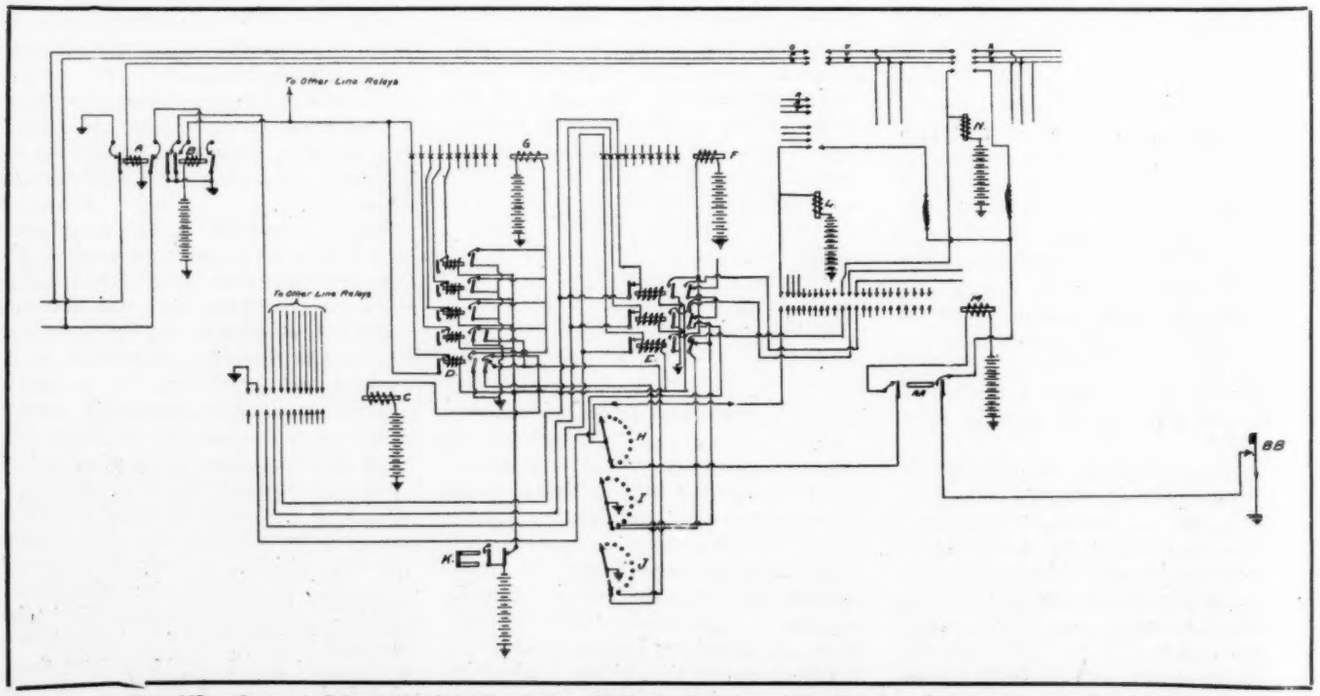

Fig. 315. General Schematic Circuit of One Method of Relay Selection Adapted to the Line-Finder Plan.

selection is found in the reduction of time required for selecting the calling line.

It will be remembered that the ordinary 100-point two-motion wiper-carrying switch is not ordinarily driven at a speed much in excess of 1,000 steps per minute, or 16⅔ steps per second. It is not customary to attempt, ordinarily, to drive the single-motion step-by-step wiper-carrying switch at a speed much in excess of 1,680 steps per minute or 28 steps per second.

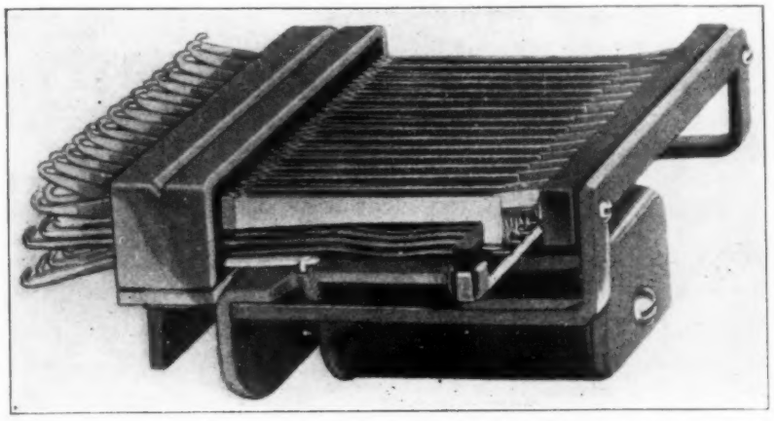

Fig. 316. Multi-Contact Relay with 31 Knife Blade Contacts.

There has been recently developed a single-motion trunk-finder line switch which drives the wipers forward over trunk contacts at a speed considerably greater than either of the two figures mentioned. Should this type of switch be placed in service, it may be found necessary to revise the present speed standards at which equipment of this character can be operated. As far as actual operation is concerned, however, the figures given represent the present maximum attainable results.

The fewest number of steps that can be taken by any two-motion 100-point line-finder switch is two—one up and one around. The maximum number that can be taken is 20—ten up and ten around. The average number, therefore, assuming that the circuits to which the switch has access are uniformly selected, is 11.

In every system in which the line-finder step-by-step wiper-carrying switch is operated, there are certain preliminary operations which precede the operation of the line-finder switch itself. In many cases these preliminary operations involve some switch stepping, but it may be assumed that the 100-point two-motion switch is started as soon as its associate trunk is selected and that its time of operation is the first component of the total trunk time required by the call.

At 1,000 steps per minute, 11 steps will require approximately 0.67 of a second, and this approximate figure is not unreasonable for the average stepping time of a switch of this character having access to 100 circuits.

If a line-finder switch of the single-motion type is used, the average number of steps to be taken will depend entirely upon the arrangement of the bank contacts. If a 50-point bank contact is employed and the wipers have access to 50 individual line circuits, then the minimum number of steps made will be zero, since the wipers in a certain proportion of the calls will be resting upon the bank contacts belonging to the calling line, and the maximum number of steps will be 50.

In this case, the average number of steps taken will be 25, and this type of switch can be driven at a speed of approximately 28 steps per second, 1,680 steps per minute. The average stepping time required, therefore, by a switch of this character, will be approximately 0.9 of a second.

It is evident, therefore, that the increased speed at which the single-motion switch may be driven is not sufficient to offset the reduction in the average number of steps required by the two-motion type of switch.

1401. *Time required for relay selection.*—An examination of the circuits shown in Fig. 315 will disclose very clearly that the selection of the calling line by the trunk lettered *X*, *Y*, and *Z*, involves the operation of six relays in succession. This may be outlined as follows:

First, line relay *B* is operated, and as a result one of the tens' relays *D* is operated. As a result, relay *C* is operated, and this causes the operation of units' relay *E*, which is followed by the operation of relay *M* and that in turn, causes the operation of relay *L* and relay *N*.

Experiments which were very carefully carried out, show that 31-point multiple-contact relays of the type that is shown in the circuit as relay *L*, would be operated on an average of 0.034 of a second. It is reasonable to assume that simpler relays, such as line relay *B* Fig. 315, would be operated somewhat quicker than the multiple contact relay *L*; but if it be assumed that all of the six relays involved in the complete connection between the trunk lettered *X*, *Y*, and *Z* and the calling line, it is readily apparent that the total selections will be complete in six times 0.034 second or a little over 0.20 second.

Any estimate of this sort is necessarily based upon very general assumptions, and it should be stated that the actual speed of stepping at which any wiper-carrying switch mechanism may be operated depends upon several factors and will be found to vary for different mechanical structures.

It is true, as a general statement, that switch mechanisms which are driven forward by current impulses produced by some form of current interrupter, which is not a part of the switch mechanism, are operating at more nearly uniform speed than those switches in which the operation of the switch itself affords the means by which the current impulses are produced. While this statement is true, it is also true that switch mechanisms, which are driven by current impulses produced primarily by the operation of the switch driving armatures, are operating at a higher speed than switches in which the current impulses are produced by a separate interrupter of one sort or another.

With this qualification, it is worthy of note that the average speed of the line-finder equipment may be roughly tabulated as follows:

100-point two-motion switch, approximately 0.67 second.

50-point single-motion switch, approximately 0.9 second.

Relay type line-finder, approximately 0.2 second.

While these results are of a very general character and are to be used with extreme caution, it appears to be obvious that the selection of a calling line circuit by any type of switch which is now in actual commercial service, where the selection is made subsequent to the receipt of the call in the central office, is accomplished in less time by the relay type of line-finder than it can possibly be accomplished by any type of wiper-carrying line-finder switch.

This is one of the greatest advantages of the relay type of selection, as the reduction average trunk time in an office handling considerable traffic load is very remarkable, and the call is delivered at the actual switching point where service begins sooner than would be the case with any other type of step-by-step wiper-carrying switch.

(*To be continued.*)

U. S. Independent Telephone Association Honored By Government.

In recognition of the great and efficient service to the signal corps performed by the United States Independent Telephone Association during the war, a certificate of merit, as shown in the accompanying illustration, has been awarded the association by the War Department.

Exchange Management Is Made Easy With Strowger Equipment

READJUSTMENTS of rate schedules in accordance with changing operating costs, and revision of service standards to comply with requirements of regulating bodies, are examples of a number of problems that are constantly arising to make the management of many telephone properties increasingly difficult.

But those telephone companies that have installed Strowger central office equipment are fortunate in having invested in property which presents among its many advantages that of ease of management.

Since all local calls in a Strowger exchange are set up entirely by mechanisms, problems relating to labor laws and working conditions are largely eliminated. The uniformly excellent service rendered in Strowger Exchanges is inherent in the equipment itself, which needs no "managing" beyond the practice of simple and inexpensive maintenance methods.

Whenever Strowger equipment is installed, changing conditions may be largely ignored because operating costs are stabilized at a minimum. Rates once fixed at an adequate point may remain so fixed and the company is spared the trouble and expense of constant rate revision.

Small outlying exchanges are often the greatest source of annoyance because the increasing necessity of giving rural subscribers adequate service 24 hours a day, often turns meager profits into substantial losses. By equipping such points with Strowger C.A.X. units, which give continuous service without attention except at infrequent intervals, the company is relieved of all operating difficulties, and the exchanges are at once made self-sustaining.

Our engineering staff will be glad to show how the management of your exchanges can be made easy and their profits adequate.

AUTOMATIC ELECTRIC COMPANY

FACTORY AND GENERAL OFFICES, CHICAGO, ILL.

BRANCH OFFICES:

New York City 21 East 40th St.	Philadelphia The Bourse Bldg.	Boston 445 Tremont Bldg.	Detroit 525 Ford Bldg.
Cleveland 415 Cuyahoga Bldg.	Columbus 516 Ferris Bldg.	Rochester 519 Arlington Bldg.	Pittsburgh 2136 Oliver Bldg.

Kansas City
1001 New York Life Bldg.

ASSOCIATED COMPANIES:

INTERNATIONAL TELEPHONE SALES AND ENGINEERING CORPORATION, New York
International Automatic Telephone Company, Ltd., London
Compagnie Francaise pour l'Exploitation des Procédés
Thomson-Houston, Paris
Automatic Telephone Mfg. Co., Ltd., Liverpool. Automatic Telephones, Australasia, Ltd., Sydney.

By special arrangements, permission was obtained by the association to make copies of this certificate for each of its member companies. These were sent out, together with a letter—part of which we quote—from F. B. MacKinnon, president of the association:

"The association has had copies made of the original certificate of merit and one of these copies is being sent to you as a member of the association, which is a testimonial from the government to you and your people of the government's appreciation of the part that you took in the war. This is fully set forth in the citation of the Chief Signal Officer, which we have printed below the copy of the certificate.

"The association and each of its member companies may well be proud of this certificate from the war department and the citation by General Squier, who personally was in close touch with the activities and sacrifices of our companies and employes.

"I take the greatest pleasure in sending the certificate to you. I am sure you will agree with me that it should be framed and hung in your office and that you will take much pride in displaying it."

MEMBER'S COPY

THE WAR DEPARTMENT OF
THE UNITED STATES OF AMERICA
RECOGNIZES IN THIS AWARD FOR DISTINGUISHED SERVICE
THE LOYALTY ENERGY AND EFFICIENCY IN THE PERFORMANCE
OF THE WAR WORK BY WHICH
The United States Independent Telephone Association
AIDED MATERIALLY IN OBTAINING VICTORY FOR THE ARMS
OF THE UNITED STATES OF AMERICA IN THE WAR WITH
THE IMPERIAL GERMAN GOVERNMENT AND THE IMPERIAL
AND ROYAL AUSTRO-HUNGARIAN GOVERNMENT

Above Certificate of Merit awarded in accordance with the following citation of the Chief Signal Officer of the Army:

"For especially meritorious service in the prompt and patriotic action of its organization and its associated companies in placing its personnel, equipment, and facilities at the disposal of the War Department. Through its hearty co-operation the Signal Corps of the Army was enabled to organize, with the splendid personnel contributed, sufficient battalions of signal troops to meet the early demands of the emergency. Its local support and technical ability, intelligence and superb qualities of the personnel furnished, aided in a high degree in the phenomenal results obtained by the Signal Corps in the part it performed in the World War. And, for the efficient and satisfactory manner in which it assisted in providing and maintaining the communication service at home notwithstanding adverse conditions such as had never before existed in the history of our country and

Texas Minimum Wage Law Repealed—Other Bill Vetoed.

Governor Neff of Texas has abolished the minimum wage law in that state by recently signing the Parr repeal bill and vetoing the Teer-Murphy bill.

The last-named bill proposed to create an entirely new minimum wage law for the state, in which it exempted all telephone exchanges in towns of 4,950 people or less, providing they did not employ more than 12 women or minors. It also contained a number of other exemptions, and the governor in vetoing this bill declared that he thought the bill as drawn would create a law that would be unconstitutional.

He stated that he was not opposed to a minimum wage law in Texas, providing one could be passed that would be fair and just to all concerned and would be workable. It will be remembered that the old minimum wage law, passed in 1919, was found, after an attempt of two years, to be unworkable. This law was wiped off the statute books by the Parr repeal bill.

A special session of the legislature of Texas will probably be called some time in the summer.

District Meeting of Illinois Independent Telephone Association.

A very successful district meeting was held by the Illinois Independent Telephone Association at Mattoon, Ill., on April 6. The meeting, devoted in general to subjects pertaining to the betterment of the service, was combined with an operators' school conducted by W. S. Vivian of the Automatic Electric Co., of Chicago. There was an attendance of 60 operators and about 35 delegates from telephone companies in the south-central portion of Illinois, representing over 50 operating exchanges.

The Eastern Illinois Independent Telephone Association, which has been inactive during the war, was reorganized with the following officers:

H. A. Faller, Robinson, president; Roy Hall, Westfield, secretary-treasurer; W. C. Lumpkin, Mattoon; Fred F. Snider, Paris; J. A. Stice, Altamont, directors.

The next meeting of this district association will be held at Altamont on May 18.

The delegates and operators present were the guests of Dr. W. C. Lumpkin, president and general manager of the Coles County Telephone & Telegraph Co.

Dr. R. E. Gordon, president of the Illinois Independent Telephone association, made the following statement concerning the meeting:

The District Meeting and Operators' School of the Illinois Independent Telephone Association at Mattoon Was an Excellent One.

"These meetings are being held for the general improvement of the service. We find that the acquaintances that are made at these conventions bring the operatives and executives of the different associating exchanges closer together. The subscriber gets better results when there is this acquaintance, gained at such gatherings of operators and executives."

Northern Indiana Telephone People Meet at South Bend.

Representatives from a number of telephone companies throughout northern Indiana held a meeting, April 1, in the Indiana Bell Telephone Co.'s building at South Bend, to discuss the problems affecting the telephone business in that territory. An operators' school was held in conjunction with the meeting.

The companies have recognized the value of uniformity of operating practices and the schools are being held for the purpose of instructing the operators so that the same practice will be followed in all exchanges. This uniformity of practice helps the operators in handling the large volume of traffic over the toll lines and helps the public in getting their toll business properly taken care of with the least amount of delay. The school at the South Bend meeting was under the direction of W. M. Kendrick, toll supervisor of the Indiana Bell Telephone Co. Miss Margaret Sheam, toll instructor, conducted the classes.

At the opening of the operators' school an address was made by F. V. Newman, general manager of the Laporte Telephone Co., of Laporte. Mr. Newman especially emphasized the importance of the Independent and Bell companies understanding each other and co-operating in every possible way.

Short talks were made by D. H. Whitman in reference to the showing made by a number of cities in handling long distance traffic, and by A. D. Lewis, division superintendent at South Bend, in reference to the importance of telephone companies mutually understanding their problems and getting better acquainted, and by Mr. Kendrick in reference to the particular matters involved in the toll traffic instructions.

Some of the companies represented at the meeting were the Merchants' Mutual Telephone Co., Michigan City; Winona Telephone Co., Plymouth; Tyner Telephone Co., Elkhart; Home Telephone Co., Goshen; Indiana Bell Telephone Co., South Bend, and other cities in northern Indiana.

Illinois Association to Reconsider Admitting Bell Interests.

At the annual convention of the Illinois Independent Telephone Association held at Springfield last November, it was proposed to change the name of the association to the Illinois Telephone Association, thus dropping the word Independent and admitting the Bell interests to membership. The proposition was voted down, but several members voting in the affirmative have requested that the proposition be reconsidered.

At the recent meeting of the northern district association of the Illinois association held at Galesburg, a resolution was adopted recommending that a special executive session of the association be called for the specific purpose of reconsidering the action taken at the annual meeting in regard to the adoption of a new constitution and by-laws insofar as such action affects the eligibility of the Bell companies for membership.

In accordance with this resolution, President Gordon has called a special meeting of the members of the association to be held Tuesday, May 10, in Springfield at the office of the secretary-treasurer.

THE WILL AND THE TONGUE

By Miss Anne Barnes.

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa.

Said the Will one day to the Tongue: "I want you to mind your own business. Now, Tongue, you know your place and also know that you are my servant. When I want any information given out as to what I think about certain people, what I am planning to do, or where I am planning to go, *you keep still* until I *will* you to talk.

"I am in an embarrassing position regarding the information you gave out concerning *my opinion* of Miss Doubtful. I did not care to have my thoughts expressed and the result is uncertain if your talk reaches her.

"That is not *all;* you have been talking—very confidentially to be sure—about what *I think* of my employer. It is *true* that I have been very angry lately regarding conditions in the office, but I did not expect to allow my thoughts to be put into words. *They were mine until you spoke them.* Now *they are mine no longer.*

"You are indispensable to me, Tongue. I cannot get along without you—and still you are my worst enemy. You must be true to me. In the future, *don't* talk unless I say 'talk' and make me say it *loud.*"

How many, many Tongues there are in this world that talk without the consent of the Will. Will sees, hears and forms impressions, while Tongue tells the world.

Two women meet on the train. After the usual commonplace remarks regarding weather, clothing and other impersonal matters, there is a lull in yonder seat.

Have they ceased to talk? No, they have just commenced to be really interesting to each other. Their voices have dropped into a confidential and regretful tone. Something like this floats across the aisle: "They *say* it is true—I don't know *anything* about her, so please do not repeat it as it may not be true," etc.

Talk, Talk, Talk—the world is full of *Talk.* The result so often is heartaches, suspicions, broken ties—yes, and even crimes.

A sure cure for one afflicted with a gossipy nature is to *think* of the following words when they feel an attack coming on:

"There is so much *good* in the *worst* of us and so much *bad* in the *best* of us, that it little behooves *any* of us to say ill of the *rest* of us."

Rochester, Minn., to Have Automatic System Cut Over.

Rochester, Minn., telephone subscribers to the number of 4,492 will have an all-automatic system at their service beginning Sunday morning, April 17, according to present plans of the Tri-State Telephone & Telegraph Co. The cut-over is scheduled for 12:01 a. m. on that date and elaborate arrangements have been made for the event, in which telephone officials and city dignitaries will participate.

To date the Tri-State Telephone & Telegraph Co. has spent a total of $217,182.07 on the new Rochester system. Of this amount, $88,862.51 has been expended on new automatic central office equipment; $77,049.46 represents cut-over expense, including changing instruments and all substation work; the new central office building has cost $24,616.28, and outside plant, both aerial and underground, $26,653.82.

The estimates call for an additional expenditure spread over these same items amounting to $21,551.91.

The Rochester plant and equipment represents a total investment as of January 31, 1921, of $507,629.96.

World's Telephonic Development

Despite World War Telephones Increased By Nearly Five Million in Six Years from 1913—Figures Published in The Telegraph & Telephone Journal, London, Show Number of Telephones of World, December 31, 1919

By W. H. Gunston

Despite four years of war in which all the larger telephone-owning countries (except Sweden) were engaged, the total number of telephones in the world has increased from about 14,500,000 in 1913 to 19,370,000 in 1919. In Europe the increase is from 3,950,000 to 4,880,000.

These figures are based on recent official information except in the case of a few countries which are not in a position to supply data. In these cases, as explained in the following notes, recourse has been had to estimates computed from the latest obtainable figure. Information respecting some of the extra-European states, whose telephonic development is in the hands of several telephone companies, is difficult to obtain, and estimates have been resorted to in these cases also.

Europe.

The total number of telephones in Europe is approximately 4,880,000, giving a ratio 1 telephone to 82 inhabitants. This proportion would be much better if Russia, Spain and the Balkans were excluded. It is a remarkable fact that within a boundary embracing Sweden, Norway, Denmark, Germany, Austria, Switzerland, Holland, Belgium and Great Britain, are included 3,870,000 of the 4,880,000 telephones in Europe, giving a ratio of 1 telephone to every 35 inhabitants.

The Latin countries account for only about 610,000 of the total number of telephones, and other states for about 400,000. Whether the striking difference in the development of the Latin states and those which are mainly Teutonic either by race or speech, is due to language, temperament, or latitude, is a problem of which there is no obvious solution.

Austria, which had 160,000 telephones in 1913 has now, after the loss of Bohemia, Carniola and the Coast provinces, 114,075. Vienna has 79,858 telephones and Graz 4,257.

Belgium had 54,691 lines in 1914, but most of these were dismantled during the German occupation. The system is so far re-established that there are now 30,383 lines which, converted to stations, should represent about 38,000. There are 10,813 lines in Brussels and 5,348 in Antwerp.

Bulgaria: No recent information is obtainable. This country had 4,378 telephones in 1915.

Czecho-Slovakia: No information obtainable. On the basis of the development of Bohemia, Moravia, etc., before the war, it is estimated that there are 54,000 telephones in this country. Prague had well over 10,000 stations before the war.

Denmark: The number of stations is given as 207,130, but this is probably the number of lines, as there were 219,460 stations in 1918 and the progress in Denmark is steady. The number of stations should be about 238,000, of which 85,363 are in Copenhagen.

Esthonia has 1,896 stations, of which 863 are in Tallinn (Reval).

Finland: No information has been received since 1911, when there were 35,000 stations in this country. As there is no clue to the rate of development, no further estimate has been attempted.

France, which had 328,000 telephones in 1913, has now 399,519, inclusive of those in Alsace-Lorraine. Paris has 149,050 stations; Marseilles 10,891; and Lyons 9,780.

Germany, despite the loss of its Polish provinces, Alsace-Lorraine and other territory, has increased since 1913 from 1,302,607 to 1,767,156 stations. Berlin has 187,982; Hamburg 80,697; Munich 41,504; Leipzig 37,732; Frankfurt 35,003; Cologne 33,764; and Dresden 32,006; while altogether 21 cities have over 10,000 stations.

Great Britain has increased from 774,300 in 1913 to 911,937. London has 311,350 stations; Glasgow 40,936; Liverpool 38,493; Manchester 37,748; Birmingham 24,528; and Edinburgh 17,224. Twelve cities in all have over 10,000 telephones each.

Greece: No information has been received respecting this country, which had 1,967 telephones in 1912.

Hungary: It is difficult to estimate the number of telephones in this country, which is not yet in a position to furnish statistics. Allowing for loss of territory, there should be about 60,000 telephones within the present limits of the republic. Budapest had over 20,000 stations before the war.

Iceland had in 1919 2,033 stations, of which 998 were in Reykjavik.

Italy: The number of telephones in 1919 (99,637) shows an actual decrease compared with 1918 (115,668). This is attributed "to the invasion of Venezia and the necessities of war." Milan has 15,331 stations, and Rome 13,425.

Jugo-Slavia: No recent information is obtainable, nor has any estimate been attempted. The few thousand telephones in this state would make little difference to the total for Europe.

Luxemburg has 5,190 telephones, of which 2,236 are in the town of Luxemburg.

Netherlands: There were 134,507 telephones in this country in 1918, and 146,416 at the end of 1919. Amsterdam has 28,157 telephones, the Hague, 19,831, and Rotterdam 23,073.

Norway also has not furnished figures for 1919. It had 122,699 in 1918, and should have about 133,000 now.

Poland: The total number of telephones is 36,169, of which 22,400 are in Warsaw. This points to an extraordinary destruction of the system during the last few years. In 1915 there were 37,000 telephones in Warsaw and Lodz alone, to say nothing of the rest of Poland, Posen, Galicia, etc.

Portugal: The Anglo-Portuguese Telephone Co. has 12,836 stations, and there are probably about 2,000 on the state system. Lisbon and district has 9,413 telephones.

Rumania: No recent information available. Rumania had 20,000 stations in 1914 and has since had a large accession of territory. On the other hand, it must have suffered considerably from the war.

Russia: No information is procurable from Russia, and any estimate of its total number of telephones must necessarily be uncertain. There were 324,500 telephones in the empire in 1915, but after deducting those in Poland and the Baltic states, about 250,000 would remain. Allowing for a decrease of 50,000 owing to unsettled conditions, 200,000 might approximate the present total in Russia, Lithuania and the Ukraine.

Spain: Information for 1919 is not yet available. There were 57,391 telephones in 1917, and at the usual rate of increase the present total might be 75,000.

Sweden: The number of telephones has increased from 234,089 in 1913 to 388,794 in 1919. Stockholm has 126,961, Gothenburg 21,850, and Malmö 11,227

Switzerland: There were 96,624 stations in 1913 and there are 138,843 now. Zurich has nearly 20,000 stations, and Geneva and Basle over 10,000.

Turkey: The Constantinople Telephone Co. had 5,820 stations in April, 1919, and 6,078 in April, 1920.

Asia.

The feature of the telephonic development of Asia is that the farther East one goes, the more telephones one finds. Japan has over 309,000; China and Hong

Kong about 33,000; Dutch Indies 32,000 and India, 30,000, while in Persia, Arabia and Turkey in Asia the telephone is practically non-existent.

The figures for Japan are official, while those for China are based on an American estimate of 27,000 for 1914. This has not been increased, as it appears to be already sufficiently liberal. An official statement shows that there were 14,112 telephones in China in 1912.

India has 10,797 stations on the government system and 19,225 on the systems of various companies. There are 7,429 telephones in Calcutta and 7,153 in Bombay.

In the Dutch East Indies there are 28,984 state telephones, and about 3,000 more on companies' systems; 7,060 of these are in Batavia, and 4,850 in Soerabaja.

The ratio of inhabitants to telephones has not been worked out in the case of Asia and Africa.

Africa.

Telephones in Africa are almost entirely confined to Egypt, South Africa and the French and other British colonies. There are 20,827 stations in Egypt, of which 8,033 are in the Cairo district. South Africa has 42,419, of which 15,657 stations are in the Johannesburg area and 7,36 stations in the Cape Town area.

North America.

The number of telephones in North America reaches the enormous total of nearly 13½ millions; of these 12,668,700 are in the United States. According to a 1919 report there were:

Bell owned	7,739,159
Bell connected	4,056,588
Independent companies (not connected with the Bell system) about	873,000
Total	12,668,700

Over 90 cities in the United States have upwards of 10,000 telephones.

Canada has 724,490 telephones, of which 314,855 are in Ontario; 119,765 in Quebec; 58,379 in British Columbia; 70,256 in Saskatchewan; and 58,854 in Manitoba.

There are 75,033 stations in Toronto; 62,622 in Montreal; 34,397 in Vancouver, and 33,682 in Winnipeg.

No recent information is available respecting Mexico or the various states in Central America and the West Indies, and recourse has been had to American estimated figures for these countries.

Asia.

	1918 (Telephones)	1919 (Telephones)
Japan	290,724	309,385
Chosen (Corea)	11,763	12,300*
Manchuria	6,558	7,000*
Formosa	6,757	7,300*
Sakhalin	819	900*
China (American est. for 1914)	....	27,000
Hong Kong	4,771	5,575
Philippine Islands based on American figures.	....	7,000
Dutch East Indies	29,348	32,000
Singapore	2,801	2,916
Malacca and Penang	....	1,339
French Indo-China	1,191	2,000*
India	26,492	30,022
Ceylon	3,011	3,100
Russia in Asia (1915)	....	18,600
Total	384,235	466,000

(Population 910 millions.)
*Estimated.

Africa.

	1918	1919
Egypt	20,689	20,827
Tunis	3,675	4,000
Abyssinia	....	105
Gold Coast (1917)	....	224
Senegal, Dahomey, French Guinea	....	500*
Madagascar	....	500*
Belgian Congo	....	200*
British East Africa and Uganda	....	600*
South Rhodesia	....	900*
Union of South Africa	38,396	42,419
Total	62,760	70,300

(Population 180 millions.)
*Estimate.

North America.

	Telephones	Population (Millions)	Ratio
Canada	724,490	8.5	11.7
United States	12,668,700	103.5*	8.2
Mexico (estimated from American sources)	42,000	16.	381.
West Indies	27,000	.....	...
Central America.	7,000	.....	...
Total	13,469,000	131.	9.7

*For 1918.

South America.

The only information obtainable respecting this continent is that supplied by the River Plate and Monte Video Telephone companies. American figures for 1919 relating to the various states have, therefore, been adopted with slight increases in each case.

South America.

	Telephones	Population (Millions)	Ratio
Argentine	105,205	9.5	90.5
Bolivia	2,650	2.9	1095.
Brazil	67,366	27.5	408.
Chile	23,670	4.0	170.
Uruguay	19,486	1.5	77.
Peru	7,148	5.6	783.
Venezuela	7,437	2.9	392.
Other states	10,902	9.3	853.
Total	243,864	63.2	257.

Australasia.

Australia: The number of stations in 1919 is as follows:

New South Wales	88,963
Victoria	62,738
Queensland	27,210
South Australia	18,526
Western Australia	12,218
Tasmania	6,275
Total	215,930

Europe.

	Telephones 1918	Telephones 1919	Population† Millions	Ratio of inhabitants to telephones
Austria	.....	114,075	9.5	83
Belgium	.....	38,000	7.5	198
Bulgaria	.....	4,378	5.5	1,256
Czecho-Slovakia	.....	54,000*	13.	240
Denmark	219,460	238,000*	2.9	12
Esthonia	.....	1,896	0.48	253
Finland	.....	35,000*	3.	86
France	367,898	399,519	41.5	104
Germany	.....	1,767,156	57.	32
Great Britain	854,043	911,909	45.5	49
Greece	.....	2,000*	6.	3,000
Hungary	.....	60,000*	12.	200
Iceland	.....	2,033	(86,500)	43
Italy	.....	99,637	37.5	375
Jugo-Slavia	.....	.....	11.6	....
Luxemburg	4,627	5,190	(259,800)	50
Netherlands	134,507	146,416	6.8	47
Norway	122,699	133,000	2.6	20
Poland	.....	36,169	13.	361
Portugal	10,935	14,000	9.6	700
Rumania	.....	20,000*	17.	850
Russia	.....	200,000*	?	....
Spain	.....	75,000*	20.	266
Sweden	373,993	388,794	5.5	14
Switzerland	124,192	138,843	3.8	27
Turkey	5,820	6,078	?	....
Total	2,218,174	4,891,093	400.	82

†The population figures are based on the latest censuses, the dates of which vary between 1910 and 1916. Those for France and the other states with altered boundaries are estimates for the years 1918 and 1919.
*Estimated. See foregoing notes.

Table Showing Total Number of Telephones in Europe.

Sydney has 54,831 telephones; Melbourne 44,003; Adelaide 14,023; and Brisbane 11,869.

New Zealand has 78,110 stations, of which 9,158 are in Auckland, 9,395 in Wellington, and 7,625 in Christchurch.

AUSTRALASIA.

	Telephones 1918	Telephones 1919	Population (Millions)	Ratio
Australia	197,610	215,930	5.5	25
New Zealand		78,110	1.2	15
Total		294,040	6.7	23

THE WORLD.

	Telephones.
Europe	4,886,000
Asia	466,000
Africa	70,000
North America	13,469,000
South America	185,000
Australasia	294,000
Total	19,370,000

The Development of Large Cities.

Eighty-six of the cities of the world contain upwards of 20,000 telephones each. Of these, 30 are in Europe, 2 in Asia, 2 in Australia, 1 in South America, and 51 in North America; or by countries, 47 are in the United States, 13 in Germany, 5 in Great Britain, 4 in Canada, and 2 each in Australia, Japan, Russia, Holland and Sweden; France, Denmark, Norway, Austria, Hungary, Poland and the Argentine have one each. The figures given for Petrograd and Moscow (those for 1916) are, of course, very questionable.

It would serve no useful purpose to calculate the ratio of inhabitants to telephones in each country. For one reason, the census figures are all old in Europe, while in America late estimated figures of population have been furnished; and for another reason, it is not known whether in foreign cities the telephone areas correspond with the municipal boundaries.* First 10 towns in the list:

		Inhabitants per telephone.
1	New York	8.5
2	Chicago	5.4
3	London	23.0
4	Boston	6.5
5	Berlin	11.0
6	Philadelphia	9.0
7	Paris	20.0
8	San Francisco	4.5
9	Stockholm	3.0
10	Detroit	7.9

*For example, the telephone development of the county of London is 270,000 stations or 1 to every 16.7 inhabitants.

Altogether there are 179 cities in the world each possessing upwards of 10,000 telephones. They are distributed as follows:—United States of America, 91; Germany, 21; Great Britain, 12; Canada, 9; Japan, 5; Australia, 4; Sweden, 3; Netherlands, 3; Switzerland, 3; France, 2; Italy, 2; Russia, 2; Austria, Czecho-Slovakia, Hungary, Denmark, Norway, Belgium, Poland, South Africa, Brazil, Argentine, Uruguay, and Cuba, one each.

Cities with Upwards of 20,000 Telephones.

New York	761,940
Chicago	504,428
London	311,350
Boston, Mass.	246,594
Berlin	187,982
*Philadelphia	180,133
Paris	149,050
San Francisco	134,043
Stockholm	126,961
Detroit	118,533
Los Angeles	121,945
*Pittsburgh	98,149
*Cleveland, Ohio	97,223
Minneapolis	92,581
Washington	85,454
Copenhagen	85,353
*St. Louis	83,880
Cincinnati	80,746
Hamburg	80,697
Vienna	79,858
Toronto	75,033
Baltimore	74,704
Milwaukee	66,513
Tokio (Japan)	64,250
Seattle	63,606
Petrograd (1916)	62,939
Montreal	62,662
Buffalo	59,422
Moscow (1916)	57,358
*Indianapolis	56,496
Buenos Aires	55,761
*Portland, Ore.	55,453
Sydney (N. S. W.)	54,831
Oakland, Calif.	53,888
Omaha	46,887
Denver	46,406
*Kansas City	45,270
Melbourne (Victoria)	44,003
Munich	41,504
Newark, N. J.	40,981
Providence, R. I.	40,977
Glasgow	40,963
Charlottenburg	39,693
Liverpool	38,493
Manchester	37,748
Leipzig	37,732
Dallas, Texas	36,234
Frankfurt-on-Main	35,003
Vancouver, B. C.	34,397
Cologne	33,764
Jersey City	33,409
Osaka (Japan)	38,002
Wilmersdorf (Berlin)	32,527
Dresden	32,006
*Columbus, Ohio	30,571
Kristiania	29,788
New Orleans	28,037
Amsterdam	28,157
*Atlanta, Ga.	27,352
Budapest (1913)	27,000
Des Moines, Iowa	26,847
Salt Lake City	25,466
Houston, Texas	25,343
Breslau	24,821
Birmingham (England)	24,528
Stuttgart	24,315
Richmond, Va.	24,281
Dusseldorf	24,198
New Haven, Conn.	24,125
Syracuse, N. Y.	23,699
Spokane, Wash.	23,678
Worcester, Mass.	23,630
Springfield, Mass.	23,591
Hartford, Conn.	23,144
Rotterdam	23,073
Albany, N. Y.	22,735
San Diego, Calif.	22,491
*Toledo, Ohio	22,449
Warsaw	22,400
Gothenburg	21,850
*Rochester, N. Y.	21,760
Hanover	20,300
Winnipeg	33,682

*These figures for these cities are those only of the Bell company. They refer to the end of 1918.

Wall Street Journal Discusses British Government Ownership.

In its column entitled "Review and Outlook," the Wall Street Journal discussed "British Government Ownership." A careful reading of the editorial by some of those who protest the telephone rates here, might cause them to stop and think before they agitate for lower rates and government or municipal ownership. The article read:

"No American traveler who has ever used the British government-owned and operated telephone system has failed to return to this country thoroughly reconciled to the American system. Perhaps the only argument for the superiority of the British service was that, up to the war, it was cheaper than ours. Any user of it would have been glad to pay American prices to secure American service.

But even this illusory advantage disappears under the new rates in England, which are now actually higher for every class of service than those of our own telephone systems. The single call is advanced to threepence—six cents—as against our five cents. The contracts are substantially more expensive, and so far from there being a guaranty of better service for higher rates, a further deterioration is a mathematical certainty.

There is a system of recording calls, and charging for them, which would not be tolerated here for a week. The renter of the telephone calls a number and is electrically recorded thereupon as making a call. After ten patient minutes, he calls "Central" again, having failed to get his number. For this "service" a second call is charged to his account. Great business organizations like Selfridge's have vainly showed the post office department, which runs the telephones, that the increase will mean thousands of pounds a year to them with less than nothing to show for it.

Our own departmental experiences in Washington might teach us to draw the lesson. An expensively conducted department is badly managed. Does it offer better service? It says: 'If you will give us more money, perhaps the service can be improved.' Having more money than enough, the department should say: 'We have made a mess of it. Give us more money and we will make a bigger mess. The more money, the more mess.'

Only one reply is made by the British bureaucrats to a storm of protest. They say: 'We need the money.' But there are already indications that on the higher tariff the net return will be smaller. Whole communities are boycotting the telephone. They say, quite truly, that they are not sacrificing much, for the service they get is only a little better than nothing. Every American who has ever called up a number in London or elsewhere in the British Isles will wonder why the long-suffering British public did not reform the system long ago—preferably with an axe."

Commissions, Courts and Councils

Discussion and Rulings of State Bodies Having Supervision Over Telephone Companies—Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchise, Rates and Service

Canadian Board Bars Measured Rate System—Allows Rate Rise.

After considering an application of the Bell Telephone Co. of Canada for increased rates, the Board of Railway Commissioners for Canada on April 2 allowed an increase in long distance and service connection charges and an additional 10 per cent on exchange revenue for service in Ottawa, but refused to permit the establishment of the measure rate system.

As a result of the ruling, according to company officials, the yearly rate for residence telephones will be advanced from $27.50 to $30.25, and for business telephones from $49.50 to $54.45.

The company asked for a measured rate of three cents a call on all exceeding 100 a month over business telephones, and an increase to $42 a year for residence telephones.

Service Efficiency Basis of Rate Increase Application.

Petition has been made by the Home Telephone Co., of Wabash, to the Indiana Public Service Commission for the establishment of a new classification rate on certain types of rural service which is to be established by the Wabash company.

In its petition the company states that it has reorganized its system so that it will be possible to give rural patrons an equivalent to the single party line service of the city for a charge slightly in excess of the present rate of $1.65 a month. The new rating would be $2 a month. The difference in service efficiency is the basis for the petition for an increase in rates.

Life Insurance Premiums Are Not Operating Expenses.

The Indiana Public Service Commission, in an order issued March 29, authorized the Commercial Telephone Co. of Warsaw, to increase its rates in accordance with the provisions of its petition. The new rates are $2.25 a month for business telephone service; $1.50 a month for residence service; and $1.75 a month for rural party service. The commission also authorized a number of other increases in special rates.

The commission, in its order, disclosed that the company had included an item of $357.96 for premiums on the life insurance policy of the manager as one of the reasons for higher rates. Although the rate increase was granted, the commission did not recognize the logic which included the manager's life insurance as an item in increased operating expenses of the company.

"The commission will take this opportunity," said the order, "to state that such an expenditure will not be permitted as operating expense insofar as the rate making is concerned, on the theory that this is purely a protective measure for the benefit of the stockholders rather than of the patrons."

Indiana Commission Gives Increase of Approximately 40 Per Cent.

Authority to increase telephone rates in Woodburn and Leo, two towns in Allen county, Ind., has been granted by the Indiana Public Service Commission. The new schedule will be approximately 40 per cent higher than the present rates.

At Leo, the New Home Telephone Co. will increase its single line rates from $1.00 to $1.50 a month; four-party business from $1.50 to $2.00; eight-party business from $1.00 to $1.75; eight-party residence from $1.00 to $1.50; and party-line rural telephones from $1.00 to $1.40.

The Woodburn Home Telephone Co. at Woodburn is given authority to increase single line business telephones from $2 to $2.75; single line residence from $1.25 to $1.75; and party line rural business from $1.25 to $2.00, with an additional charge of 25 cents for each service for each quarter of a mile beyond the corporate limits of the town. Party line residence service, will be increased from $1.25 to $1.75.

The commission also has issued an order establishing a new rate for the Mechanicsburg, Markleville & Emporia Telephone Co., ruling that the subscribers should pay $12 per year for the service and that the company shall receive $10 a year for switching service. It was shown that there are several different companies, in which the subscribers maintain and own all the lines, exchanging through the Mechanicsburg, Markleville & Emporia Co.'s switchboard. The commission recommended that an effort be made to consolidate some of these companies in the interest of better service.

Rates for P. B. X. Service in Indianapolis After Consolidation.

Rates now in effect for private branch exchange service of the Indiana Bell Telephone Co. will prevail for service provided through the consolidation of the manual and automatic exchanges, according to an order issued recently by the Indiana Public Service Commission. The Indiana Bell company is unifying the branch exchanges in Indianapolis as the first step in the complete consolidation of the two telephone systems.

"Preparatory to the final consolidation and unification of telephone service in the city of Indianapolis," says the commission's order, "the Indiana Bell Telephone Co. is now engaged in consolidating and unifying local private branch exchanges where duplication of service exists. In cases where two private branch exchanges, Bell and automatic, are now being maintained and are consolidated, the subscriber will obtain identically the same service that will be obtained by all subscribers after the complete unification of telephone service in Indianapolis.

"In other words, where one subscriber now has two private branch exchanges, one of such exchanges is to be eliminated and trunk lines connected with the remaining private branch exchange will be connected with both manual and automatic telephone systems in the city."

The unification of the manual and the automatic telephone systems in Indianapolis will be completed by September 1, according to an announcement issued recently by the company. Four hundred men are at work putting in the equipment, according to Charles A. Breece, who is in charge of the work. The cost of apparatus and labor will exceed $1,000,000.

Rates Increased—Contingent Upon Higher Wages to Operators.

The Kansas Court of Industrial Relations recently granted authority to the Russel Telephone Co., of Russel, to increase its rates for service to the following schedule, contingent upon an increase in the wages of its manager, linemen and operators:

Independent line business	$2.60
Independent line residence	1.60
Rural party line residence	1.60

The Russel Telephone Co. was ordered to set aside $2,374.06 per year for a depreciation reserve and to keep its accounts in accordance with the Interstate Commerce Commission's system of accounting for Class C companies.

Minnesota Companies Get Higher Telephone Rates.

The Minnesota Railroad & Warehouse Commission issued orders on March 29, 30 and 31, granting increased telephone rates to the Citizens Home, the Dexter, and the Jordan Telephone Cos. All increases became effective April 1.

The Dexter company, operating 372 stations in Dexter and vicinity, was authorized to increase its rates from $1 per month for all classes of service to the following monthly schedule:

Individual line, business	$2.25
Two-party line, business	2.00
Extension station, business	.75
Individual line, residence	1.50
Four-party line, residence	1.25
Extension station, residence	.50
Rural multi-party	1.25
Extension bells	.15

The old and new net monthly rates of the Citizens Home Telephone Co., which operates a common battery exchange at Belle Plaine, serving approximately 582 stations and performing switching service for 94 rural connecting company stations, compare as follows:

	Old.	New.
Individual line, business	$1.75	$2.50
Two-party line, business	1.50	2.25
Business extension	.25	.50
Individual line, residence	1.25	1.50
Two-party residence	1.50	...
Four-party line, residence	...	1.25
Residence extension	.25	.25
Rural multi-party	1.25	1.50
Rural switching	.25	.35

Here are the old and new net monthly rates of the Jordan Telephone Co., of Jordan:

	Old.	New.
Individual line, business	$1.75	$2.25
Two-party line, business	...	2.00
Individual line, residence	1.25	1.50
Four-party line, residence	1.00	1.25
Extension business	.50	.50
Extension residence	.50	.25

The Jordan company operates a magneto exchange at Jordan, serving 159 town stations and performs switching for 230 stations of the Scott County Telephone Co. Approximately 40 cents per month per station is paid by the Scott County company for this service.

Rehearing in Cumberland Rate Case in Louisiana.

The Louisiana Railroad Commission handed down a decision on April 1 granting a rehearing in the rate advance of the Cumberland Telephone & Telegraph Co. for a period not to exceed four months, during which time new evidence against the 20 per cent increase will be received.

The advanced rates are to remain in force during the four month-period, pending final decision, and the company is directed to so keep its accounts and records that a refund may be made in the event that the rates are found to be excessive.

Inasmuch as the company failed to give notice in printed schedules of its advance in rates for joint user service, these advances are suspended, pending further order.

The decision of the commission is lengthy, comprising 28 written pages and sets forth the reason why the commission put the rate advance in effect at the time and contains an exhaustive review of the case since its filing on September 22, 1920 to date. Each point raised in the application for the second rehearing is fully discussed.

The order takes note of the state-wide requests for a reopening of the case, and on this point says: "Since our order was issued numerous requests have come from various parts of the state for an opportunity to present additional evidence. Among those who appealed to us for a reopening of the cases were distinguished jurists and prominent business men. Their requests were not based upon any error in our former findings, but were based solely upon statements to the effect that some interested parties may have slept on their rights in not appearing before the commission and presenting their views at some one of the several hearings had in the case. We recognize the force of the appeals, and as there is a state-wide interest in the case, we will afford the opportunity desired."

Plant Efficiently and Economically Operated—New Rates.

Finding the property of the Pelican Telephone Co., of Pelican Rapids, Minn., to be economically and efficiently operated, the state railroad and warehouse commission on March 29 granted permission to the company to increase its rates and establish service connection and other miscellaneous charges. Here are the old and new monthly rates and the service connection charges:

	Old.	New.
Individual line, business	$2.00	$2.50
Extension station, business	1.00	1.00
Individual line, residence	1.00	1.50
Two-party line, residence	1.00	1.25
Extension station, residence	.50	.50
Rural multi-party	1.00	....
Rural multi-party, metallic circuit	...	1.50
Rural multi-party, grounded circuit	...	1.25
Rural switching charge	$4.00 per year	.35
Schoolhouses in village	.50	.50
Schoolhouses, rural (per year)	...	2.00
Extension bells	...	.25

SERVICE CONNECTION CHARGES.

	Business stations.	Residence stations.	Extension stations.
Instrument not in place	$2.00	$1.50	$1.00
Instrument in place	1.50	1.00	No charge

The Pelican Telephone Co. serves approximately 596 town and rural stations and performs switching service for 108 rural connecting line stations. It also owns and operates a toll line between Pelican Rapids and Barnesville.

New Rates and Service Connection Charges Approved.

The New York Mills Telephone Co., serving 182 stations and performing switching service for 171 subscribers at its New York Mills and Bluffton exchanges, and the Redwood County Rural Telephone Co., serving 1,210 stations and performing switching service for 435 rural connecting line stations at its Redwood Falls, Morgan, Wabasso, Walnut Grove, Belview, Echo, Vesta and Delhi exchanges, were authorized by the Minnesota Railroad & Warehouse Commission to increase rates and place in effect service connection and miscellaneous charges on April 1.

The old and new monthly rates of the New York Mills company compare as follows:

	Old.	New.
Individual line, business	$2.25	$2.25
Extension station, business	...	1.00
Individual line, residence	1.25	1.50
Two-party line, residence	...	1.25
Extension station, residence	...	.50
Rural multi-party, grounded circuit	1.00	1.25
Rural switching charge	.25	.50
Extension bells	...	.25

Here are the old and new monthly rates of the Redwood County Rural company:

	Old.	New.
Individual line, business	$1.50	$2.55
Extension station, business	.50	1.00
Individual line, residence	1.00	1.50
Two-party line, residence	.75	1.25
Extension station, residence	.50	.50
Rural multi-party	1.25	1.50
Rural switching charge	.25	.35
Lodges, halls and schools	1.00	1.00
Extension bells	...	.25

Service connection charges, which are the same for both companies, follow:

SERVICE CONNECTION CHARGES.

	Business stations.	Residence stations.	Extension stations.
Instrument not in place	$2.00	$1.50	$1.00
Instrument in place	1.50	1.00	No charge

The Redwood County Rural company was authorized to amend its present toll rate between its various exchanges to 15 cents for three minutes and 5 cents for each additional minute.

Missouri Mutual Company Votes to Increase Rates.

At a meeting of a number of the subscribers of the Rock Port Mutual Telephone Co., of Rock Port, Mo., held recently, it was voted to advance the monthly rates to all users of telephones on the local exchange.

The advance is made necessary to take care of outstanding indebtedness and care for running expenses.

As voted by those present at the meeting, the following rates will prevail, effective March 1, and continue for at least two years. At the end of two years, if it is found that the new rates are not necessary for the further financing of the company, a readjustment will be made.

The new rates are:

Business telephones, $1.75 per month, with additional charge of 25 cents for extension telephone; residence telephones.

$1.25 per month, with 25-cent charge for extension telephone; on rural lines, 50 cents per telephone per month.

Rates Increased Temporarily in Platte County, Mo.

Rates of the Platte County Telephone Co. in Platte City, Mo., were increased to the following schedule on April 1 for a temporary period of 13 months, under an order issued March 22 by the state public service commission:

Business, direct line	$27
Business, extension sets	12
Residence, direct line	21
Residence, two-party	18
Residence, extension sets	12
MOVING CHARGE.	
Instrument moved within the room or style of instrument changed	$0.50
Instrument moved within the building	1.00
Instrument moved outside the building	1.50
EXTRA SERVICE CHARGE.	
Business (per month)	$1.00
Residence (per month)	.75
Class B Service:	
Business	$27
Residence	21
Class C service	17
Desk sets, additional	3

Rentals due and payable at the end of each month. Discount of 25 cents per month allowed for payment by the 15th of the succeeding month.

Testimony was introduced at the hearing by subscribers complaining against the service rendered on rural lines. The manager of the company testified that the company's lines were being rebuilt, a new switchboard had been installed, and that every effort was being made to improve the character of the service.

Rate Increase Is Denied—Move Charges Approved.

In an order issued March 30, the Missouri Public Service Commission modified its supplemental order issued April 22, 1920, so as to permit the Citizens Telephone Co. to incorporate within its existing schedule of rates for service at its Mayview, Higginsville and Corder exchanges, the following move charges:

Instrument moved within room, or style of instrument changed	$ .75
Instrument moved within the building	1.25
Instrument moved outside building	2.25

The original application of the company for increased rates was filed in 1918. The effective date of the increase was postponed from time to time by the commission until on December 23, 1919, an order was issued granting increased rates.

Later after the filing of a motion for rehearing and a hearing thereon, further order was issued on April 22, 1920. On August 18, the company asked that the order issued on the rehearing be modified so as to increase the business and residence rates at Corder and Mayview and the institution of certain move charges.

The commission found the fair value of the company's property for rate-making purposes to be $70,637.37. From the exhibits introduced by the company showing its earnings for a six-months' period, it is shown that the company earns a return of 10.6 per cent on the value of its property. In view of the fact that the rates at Corder and Mayview are higher than those charged in similar conditions in the state, the commission ordered that the schedules remain as they now stand, with the exception of the move charges.

Authorized to Increase Its Local and Rural Telephone Rates.

An increase in its local and rural rates was granted the Cokato Telephone Co., of Cokato, Minn., by the state railroad and warehouse commission on March 30. Effective April 1, the rates are as follows:

	Old.	New.
Individual line, business	$1.50	$2.25
Individual line, residence	1.00	1.50
Rural multi-party	1.00	1.50
Extension, business	1.00	1.00
Extension, residence	...	.50
Extension bell	...	.25

SERVICE CONNECTION CHARGES.

	Business stations.	Residence stations.	Extension stations.
Instrument not in place	$2.00	$1.50	$1.00
Instrument in place	1.50	1.00	No charge

The Cokato Telephone Co. operates a magneto exchange at Cokato, serving approximately 234 local and 234 rural stations.

Patrons Are Willing to Pay Any Rate Fixed.

A telephone company has been discovered in Nebraska that has a solid body of subscribers who are not only not asking for reduced rates at the present time, but who are willing to pay any schedule of rates that the state commission says is right and proper. This is the official finding of that body, and the name of the organization is the Chappell Telephone Co.

Chappell is the county seat of Deuel county, once a big ranch section in Nebraska, but now making a remarkable growth because of the discovery that it is specially adapted for wheat. Many farmers have been getting as much each year net for the crop as the land cost them some years ago.

L. Remilliard, educated in the Bell school, bought the plant for $11,500 last October. Since then he has spent about $7,000 making it all metallic and all cable. In appreciation of his enterprise and keeping step with the town's ambitions, the patrons told him to make the service first-class and they would not kick on any rates. Not a protest was filed.

The rate order, which expires by limitation on October 1, 1921, permits the individual business rate to be increased from $2.50 to $3.00; party business, from $2.25 to $2.75; individual residence, from $1.50 to $1.75; party residence, from $1.25 to $1.50. Residence extensions, 50 cents; business extensions, $1.00.

The commission held that it did not have jurisdiction to fix the charge that the company might make to other companies for space on its poles—that this is a matter for private agreement and not a part of regulation.

The Franchise Situation of Louisville (Ky.) Company.

At the last meeting of the Louisville, Ky., City Council the measure to grant a new franchise to the Louisville Home Telephone Co. and increase rates, failed to come before the board of aldermen. This measure passed the lower council, but, reports state, will meet with greater opposition in the higher board. A local newspaper in discussing it recently before the meeting of the council, said:

"A lively discussion of the ordinance which provides for an increase of approximately 25 per cent in the rates of the Louisville Home Telephone Co. is in prospect at the meeting of the board of aldermen.

President Kirwan has always opposed an increase for this company on the ground, he says, that it has always been able to pay a reasonable dividend on its stock. It is believed he will leave the chair and speak against the measure."

Operating and Overhead Costs—What Are They?

Something new in the way of telephone company applications was filed with the Nebraska State Railway Commission the other day. It came from the High Line Telephone Co., of Orleans, and asked if there was any way by which the company could reduce its residence rates from $1.35 to $1.10 a month.

The company was informed that the only way open to a company desiring to reduce rates was the same one prescribed for one that desired to raise them; an application must be filed, a hearing held and a finding of fact made. It was suggested that the company need have little apprehension of a protest against the reduction from its patrons.

Supreme Court to Decide on New York Case April 18.

Supreme Court Justice Lehman on April 5 heard the suit of the city of New York against the New York Telephone Co. for an injunction restraining the company from increasing its rates 20 per cent in accordance with an order of the New York Public Service Commission granting the temporary increase pending the hearings for a permanent rate, which are not expected to end until fall. Justice Lehman reserved decision, but in the course of the argument he said:

"If there is sufficient here to give me jurisdiction and the order is illegal, I think an injunction almost certainly will

follow, but I have serious doubts as to the illegality of the order."

Justice Lehman said he would hold as a matter of law that the city authorities had done what they could to expedite the case, and when the argument was closing said:

"It is not this proceeding in the nature of a sentimental motion or one to get a ruling by the court of the legality of the order. I feel for you in your effort to get some remedy. But it seems to me the case is one in which sentiment governs to some extent. Let us drop all camouflage and discuss the question frankly."

Because an early decision is imperative, the court directed the attorneys to submit all papers not later than Thursday, April 14. A decision by Justice Lehman is to be rendered on April 18.

Bell Company Denied Higher Rates in North Dakota.

The North Dakota Railroad Commission on April 9 denied the petition of the Northwestern Bell Telephone Exchange Co. for increased telephone rates, and decided to conduct further hearings on the reasonableness of the proposed rates filed with the commission.

In denying the petition the commission's statement read:

"The commission appreciated the spirit of co-operation manifested by this application and realizes that, so far as operating revenues, expenses and plant values are concerned, the showing is well made and indicates the necessity for additional revenue. The same condition, however, prevails in all lines of industry. Heavy losses are being sustained by farmers and merchants. This will continue until general conditions return to normal and the commission does not feel that a general increase should be granted at this time."

The statement added that the telephone company in its petition quoted an order of the minimum wage commission as one of its arguments for higher rates, that this order, however, is not being enforced and that increased expenses, due to it, could not be considered, until the matter had been decided by the court.

Further hearings on the proposed rates were set for May 9, at Jamestown; May 10, Fargo; May 11, Grand Forks, and May 12, Rugby.

Bradley-Crocker (S. Dak.) Company Increases Rates.

The South Dakota Railroad Commission issued an order recently authorizing the Bradley-Crocker Telephone Co. to increase rates at its Bradley and Crocker exchanges from $1.25 to $1.50 per month for all classes of service, effective April 1.

The Bradley-Crocker company furnishes service to 65 subscribers at Bradley and 90 at Crocker. A fair value of its property for rate-making purposes was found by the commission to be $5,500.

Records of the company show that commissions covering the handling of toll business are retained by the operators. The commission recommended that the salaries of the operators be definitely fixed and all revenues accruing in connection with the furnishing of toll service be included in revenue accounts.

Good Service Rendered—New Rates Fixed.

The Dakota Central Telephone Co. having filed application with the South Dakota Railroad Commission asking that it fix a fair and reasonable rate for rural party line service in the Watertown exchange area, an order was issued by the commission on April 1 setting $1.50 net per month as a fair rate. The company is permitted to bill subscribers 25 cents per month in advance of the net rate, which amount is to be deducted as a discount for prompt payment.

The old rate was $12 per year when rentals were paid yearly in advance, or $1.50 per month when paid monthly.

From the evidence submitted and the records of the company, showing its operating revenue, expenses, maintenance costs, etc., the commission is of the opinion that $16,000 is a fair value of the company's property for rate-making purposes. It is estimated that the new rates will yield a return of 6.8 per cent on this fair value.

Testimony was introduced at the hearing by subscribers complaining against the quality of service rendered. Since that time the company has placed all of its rural lines in good operating conditions and subscribers now report that the service rendered is entirely satisfactory.

The Dakota Central company serves 211 subscribers in the Watertown district and furnishes switching service to 290 subscribers of farm lines not owned by it.

Rate Increase Granted Several Minnesota Companies.

A number of Minnesota telephone companies were granted increased rates, to become effective May 1, by the state railroad and warehouse commission in orders issued April 8. The old and new rates and the companies granted increases are:

The J. O. Solie Telephone Co., of Fountain, granted permission to increase its rates from $1 per month for individual line business and residence service and $2 per year for rural switching service to the following schedule:

Individual line, business	$2.00
Individual line, residence	1.50
Rural switching service	.40

The J. O. Solie company is individually owned and serves 15 town stations and performs switching service for 179 rural stations. In the past the rural subscribers had the choice of accepting switching service on a flat rate basis of $2 per annum or 10 cents per message.

Telephone rates of the Chokio Telephone Co., operating a magneto exchange in Chokio, serving 80 town stations and performing switching service for 150 rural connecting stations, are increased as follows:

	Old	New
Individual line, business	$1.50	$2.25
Extension, business	.50	.50
Individual line, residence	1.00	1.50
Two-party line, residence		1.25
Extension, residence	.50	.50
Extension bells		.25
Rural switching (per year)	3.80	4.20

With a minimum charge of $1.50 per month per circuit.

Service Connection Charges

Instrument not in place—	
Business stations	$2.00
Residence stations	1.50
Extension stations	1.00
Instrument in place—	
Business stations	1.50
Residence stations	1.00
Extension stations	No charge

The following increase in rates was granted the Farmers Two Rivers Rural Telephone Co., operating exchanges at Lancaster and Bronson, and serving 438 stations:

	Old	New
Individual line, business	$1.25	$2.25
Two-party line, business		2.00
Individual line, residence	1.25	1.50
Four-party line, residence	1.00	1.25
Rural multi-party	1.00	1.50

The Lowry Telephone Co., of Lowry, will increase its rates from $1.50 per month for individual line business and $1 per month for individual line residence and rural multi-party service to the following schedule:

Individual line, business	$2.25
Individual line, residence	1.50
Rural multi-party	1.50

Approximately 428 town and rural stations are served by the Lowry Telephone Co. at its Lowry and Farwell exchanges.

South Dakota Cities Lose Fight Against Telephone Charges.

The South Dakota Railroad Commission on April 7 denied the application for rehearing of the telephone rate case, asked by the city authorities of Watertown and Mitchell. The petitioners are granted by law 30 days to obtain a writ of certiorari in the supreme court to compel the commission to bring its records of the previous hearings before the court for examination.

Litigation over telephone rates in the state started in November, 1919, when the Northwestern Telephone Exchange Co., the Dakota Central Telephone Co. and the Nebraska Telephone Co., asked the commission to approve the continuance of the removal and installation rates and the

exchange rates established as a war measure in the fall of 1918 and spring of 1919.

Pending its decision the board issued a temporary order allowing the continuation of these rates as asked by the companies.

Hearings were conducted in nearly all cities of the state, the individual petitions of each company being first considered separately and later collectively at two hearings in Sioux Falls.

The result was that the board gave permission to the companies to continue the exchange rates established during the war, but ordered a reduction of the installation and removal rates.

The city officials of Watertown and Mitchell maintained that the commission in authorizing the continuation of these exchange rates, overstepped its jurisdiction in that by so doing it is depriving the cities of their right to regulate such utility rates by franchise.

South Dakota Rural Company Increases Rates in Rosholt.

On May 1 telephone rates of the White Rock Rural Telephone Co. will be increased to the following schedule, under an order handed down April 7 by the South Dakota Railroad Commission:

	Old	New
Business main line	$1.50	$1.75
Business party line	1.50	1.75
Residence maine line	1.00	1.25
Residence party line	1.00	1.25
Rural party line	1.00	1.25

The White Rock company operates an exchange at Rosholt and serves 285 subscribers. A fair value of its property for rate-making purposes was found by the commission to be $10,000.

Ordered to Cease Paying Dividends—Higher Rates Granted.

An increase in rates covering telephone service in Salem, S. D., was recently granted the Salem Telephone Co., serving 314 subscribers, by the state railroad commission. The new monthly rates which will become effective April 1, follow:

Main line, business	$2.00
Party line, business	1.75
Main line, residence	1.40
Party line, residence	1.25
Rural party line	1.25
Desk sets, extra	.25
Extension sets	.50
Extension bells	.25

Records of the company showed that no depreciation reserve had been set aside, although stockholders had received in cash dividends an average annual return of slightly in excess of 10 per cent. Had the company set aside a depreciation reserve from its earnings equalling the excess over a 7 per cent return paid in dividends, the commission states, there would be more than sufficient cash on hand to provide for replacement and renewals.

In view of the depreciated condition of the plant and the company's failure to set aside a depreciation reserve, the commision ordered that payment of further dividends be deferred until a surplus of at least $2,000 has been provided for. The fair value of the company's property for rate-making purposes was found by the commission to be $13,500.

Utah Commission Upholds Burleson Exchange Rates.

Telephone rates, with the exception of the measured service rates, established by Postmaster-General Burleson, now in effect in the Utah portion of the Mountain States Telephone & Telegraph Co.'s system, are upheld by the state public utilities commission in a decision rendered March 29.

Patrons of the company's measured service will receive refunds of all charges in excess of those which would have accrued, since December 1, 1919, under the new schedule established by the decision.

The measured service charges ordered will give Salt Lake a four-party line service with an annual message allowance of 720 calls, and an annual rate of $24, with 5 cents for each additional call. The conditions are the same as at present, except that the present annual message allowance is 480 calls.

The two-party measured service will give 810 calls a year at $27, with four cents for each additional call. The present limit is 45 calls a month, or 540 calls a year.

The individual residence line measured service will give 960 as the annual message allowance, at $33, with a three-cent charge for each additional message. The present allowance is 55 calls a month, or 660 a year.

The measured service on the individual business line will be 1440 calls a year at $48 and three cents for each additional call, instead of the present 80 calls a month or 960 a year.

The commission found the value of the company's property, used and useful in giving telephone service within the state of Utah, as of January 1, 1921, to be $8,662,167.11.

The relation of the company to the Western Electric Co. and the American Telephone & Telegraph Co., was considered at some length, and it was found that taken as a whole, the present contract appeared to be beneficial to the utility.

On April 1 the company filed a petition with the commission asking a rehearing on the question of measured rates.

Prosser, Wash. Company Withdraws Petition for Higher Rates.

The Washington Public Service Commission recently reported the finding of an oddity, a modern freak. The Benton Independent Telephone Co., of Prosser, informed the commission that it wished to withdraw the tariff filed last month which proposed to increase its rates.

The communication from the company stated that the company would cut its expenses and keep the rates at the old price, because the president and manager of the company felt that it would be an injustice to the farmers of the district to increase the rates, as they, the farmers, were in such bad financial condition. The president and manager made a personal survey of the situation.

Although the commission daily receives petitions for increased tariffs, this is the first one received in months petitioning to keep the rates at the old price.

Higher Rates Contingent on Reduction in Subscribers on Line.

In an order issued March 31, the Wisconsin Railroad Commission authorized the Badger Mutual Telephone Co. to increase its net rate schedule, effective April 1, as follows:

	Old	New
Business one-party	$1.75	$2.25 per mo.
Business two-party	1.50	1.75 per mo.
Residence one-party	1.50	1.75 per mo.
Residence two-party	1.25	1.50 per mo.
Residence three to five-party	1.00	1.50 per mo.
Rural multi-party	1.00	1.25 per mo.
Switching service	.35	.50 per mo.

The company was also ordered to reduce the loading of its rural lines to a maximum of 12 subscribers per line and was allowed 60 days within which to comply with this part of the order.

The company operates a magneto exchange in the village of Webster, serving 309 subscribers, 198 of whom are rural subscribers. The value of the property on December 31, 1920, was reported by the company to be $5,460. The operating revenues for the year ended December 31, 1920, were $3,242.15 and the operating expenses for the same period were $3,386.50, leaving a deficit of $144.35 before providing for depreciation and return upon the investment.

Rates Increased Contingent Upon Improved Service.

Pending a reduction in the number of subscribers on its lines within 60 days, telephone rates of the Jackson Telephone Co., serving 293 subscribers at Jackson and in the territory tributary to Jackson and West Bend were increased to the following schedule on April 1 under an order issued March 18 by the Wisconsin Railroad Commission:

	Old, per month.	New, per quarter.
Business, one-party	$2.00	$7.25
Business, two-party	....	6.50
Business, six-party	....	5.75
Business, multi-party	1.50	....
Residence, one-party	1.75	6.50

Residence, two-party...	....	5.75
Residence, six-party...	....	5.00
Residence, multi-party.	1.25	....
Rural business party...	....	5.75
Rural residence party..	....	5.00
Rural residence, West Bend	....	5.75
Rural service	1.25	....
Extension bell	....	.45
Installation charge ...	....	2.00
Move charge	....	2.00

The book value of the plant was found to be $10,361.91, which is an average of $44.75 per subscriber. This amount was used by the commission as a fair value of the company's property for rate-making purposes.

A petition signed by 44 subscribers was received by the commission protesting against the proposed increase in rates, alleging poor service. An investigation of the company's plant was made by the commission's service department and it was found that the wiring between the main line and the telephone itself was very poor, the wire being tacked to the houses with uninsulated tacks, line wires were put with arrester ground wires in running them into the house, and poor lightning arresters were used, which together with the overloaded condition of the lines, caused unnecessary noise on the lines. The company was ordered to generally improve the condition of its lines and report to the commission the work completed within 60 days.

New Rate Schedule Approved for Wisconsin Farmers' Association.

In an order issued April 8 by the Wisconsin Railroad Commission, the Farmers Independent Telephone Association, furnishing service in Caroline and the surrounding rural territory, is authorized to increase its net annual rates as follows:

	Old.	New.
Residence, party line, grounded..	$12	$15
Residence single line, grounded.. ..		18
Residence single line, metallic...	18	21
Business party line, grounded...	15	18
Business single line, grounded... ..		21
Business single line, metallic....	21	24

The commission found that only about 20 of the instruments are furnished by the company, and therefore ordered that a rental charge of $3 per year or 25 cents per month be paid to subscribers furnishing their own instruments. A charge of $1 for inside or outside moves and $2 for installations, the installation charge subject to refund if the subscriber continues service for a period of two years, were also authorized.

Ordered to Reduce Subscribers On Line—New Rates.

Contingent upon a reduction in the number of subscribers on each line to a maximum of 15, the Calumet Telephone Co. is authorized by the Wisconsin Railroad Commission in an order issued March 18 to increase its rates for local and rural service from $12 per year to $1.50 per month per subscriber.

The book value of the company at the end of 1920 was shown as $5,536.40. The commission finds that the average investment of $31.46 per subscriber is somewhat low, but in view of the fact that there is an average wire mileage of only one-quarter of a mile per subscriber and a total mileage of one-fifth of a pole mile per subscriber, the book value seems to be a fair value of the company's property.

The charge of 25 cents collected by the company for night calls was found by the commission to be excessive and a charge of 10 cents for all such messages approved. The commission ordered further that service be given from 6 a. m. to 10 p. m. without a message charge, instead of 6 to 9, as in the past.

The Calumet Telephone Co. serves 176 subscribers situated in the vicinity of Forest Junction.

Rural Multi-Party Rates Increased in Oconto, Wis.

The Wisconsin Railroad Commission on March 28 authorized the Oconto Rural Telephone Co. to increase its rates for rural multi-party service within six miles of its central office at Oconto to $2.00 net per month, effective April 1.

An excess radius charge for stations beyond the six-mile radius of 25 cents per month for each mile or fraction thereof is authorized. The old rates were $15 per year for residence service and $18 for business service.

The company operates a telephone exchange in the village of Abrams, serving 113 subscribers on 22 metallic lines, and in addition owns 23 metallic circuits serving 284 rural subscribers, which are connected to the Oconto exchange of the Wisconsin Telephone Co. The book value of the rural property on December 31, 1920, was reported to be $27,669.48. The value of the company's property used in serving the subscribers connected to the Oconto exchange was found to be $17,500.

New Rate Approved Between Waunakee and De Forest, Wis.

Authority to discontinue its present charge of $36 for switching service to the Poynette Telephone Co. and substitute therefor a charge of $6 per year per subscriber was granted the Waunakee Telephone Co. by the Wisconsin Railroad Commission in an order handed down March 31.

This switching charge applies to about 13 subscribers of the Poynette company who receive service from a through grounded line, owned by the Poynette company, which connects the Waunakee exchange with the DeForest exchange of the Poynette company.

In its application the company stated that all of the subscribers in question were within four and one-half miles of its exchange and well within its rural exchange limits, and therefore should be included as Waunakee company subscribers. The commission was asked to pass upon the question of future ownership of the system serving these 13 subscribers.

In its opinion, the commission states that it has no authority to compel the Poynette company to give up these subscribers to the Waunakee company, but recommended that the Poynette company arrange to sell its property, inasmuch as subscribers so far from the Poynette company's office could not be economically served, and the company would thus gain by transferring them to the Waunakee company. In the event that such an arrangement is made, the line to the DeForest exchange would be discontinued.

The commission also recommended that the two companies arrange to build a through metallic toll line between the two exchanges and institute a toll charge of 10 cents per message.

Summary of Commission Rulings and Schedule of Hearings.

CALIFORNIA.

April 2: Complaint filed by L. LeRoy King, of Roseville, against the Roseville Telephone Co., asking that the Roseville Telephone Co. be compelled to restore to him the telephone number under which he was listed before changing his office temporarily. He says the number was used by himself and his father for many years and that the change has injured his business.

ILLINOIS.

March 29: Order issued amending order of February 1, 1921, which authorized the Illinois Bell Telephone Co. to discontinue its exchange at Trexler and joint application with the Mutual Telephone System of Mulberry Grove for approval of sale by the former and purchase by the latter of certain rural lines now connected with the Trexler exchange of the Illinois Bell company, so as to read that the transfer will take place within 60 days and that the Mutual company shall make a certified report to the commission. Section D of the February 1 order is cancelled.

March 29: Order issued suspending until August 21 proposed advance in rates in Anchor by the Anchor Telephone Co.

March 29: Citation order issued directing the Chesterfield Telephone Co. to appear before the commission on April 22 and show cause why it has failed to repair its portion of the toll circuits between Chesterfield and Carlinville.

March 29: Order issued suspending until August 12 proposed advance in rates in Albion by the Independent Telephone Co.

March 31: Order issued approving the sale by the Illinois Bell Telephone Co. to the Western Union Telegraph Co. of certain manholes and conduits in Elgin for $1,200.

March 31: Order issued extending until July 1 the time in which the Western Illinois Utilities Co. and the LaHarpe

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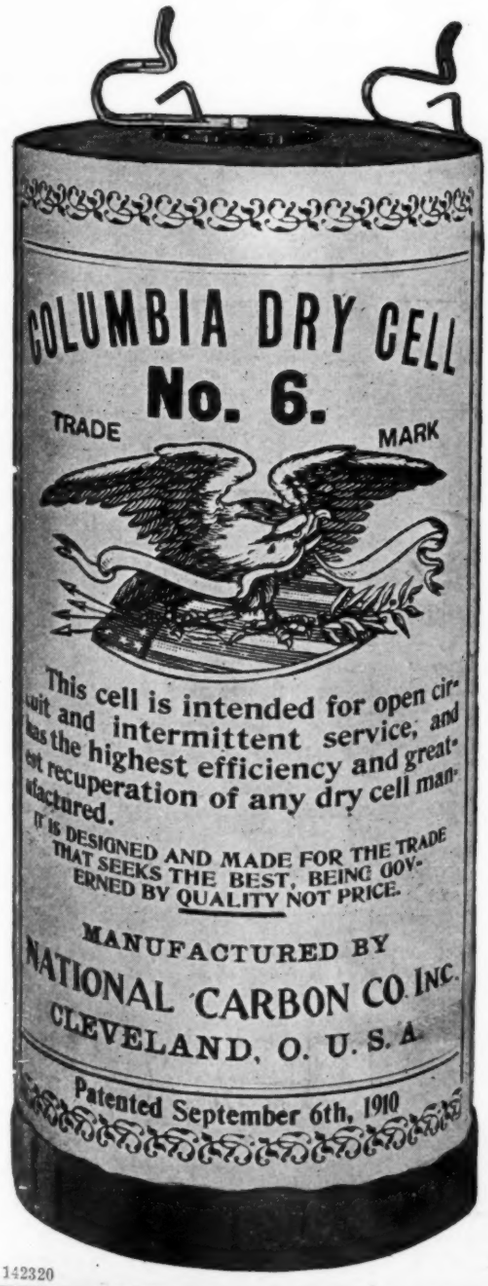
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Telephone Co. must carry out such physical improvements on their systems as may be necessary to eliminate inductive interference.

March 31: Orders issued cancelling rate schedules IPUC 201 to 355 of the Chicago Telephone Co., filed June 7 and July 5, applying to various cities and villages served by the company.

March 31: Order issued dismissing complaint of Myer J. Stein against the Illinois Bell Telephone Co. in re discriminatory rates in effect by the defendant company.

March 31: Order issued dismissing complaint of the Farmers Fountain Telephone Co. against the Cahokia Telephone Co. and the Harrisonville Telephone Co. in re recession or modification of agreement between the two companies dated June 8.

March 31: Supplemental order issued approving agreement entered into by the Farmers Fountain Telephone Co. and the Cahokia and Harrisonville Telephone companies.

March 31: Order issued authorizing the Vancuren Telephone Co. to purchase certain property in Hammond from the Atwood Mutual Telephone Co.; granting a certificate of convenience and necessity to the Vancuren company and authorizing it to issue $6,000 capital stock.

April 13: Hearing at Chicago on application of the Crescent Telephone Co. for authority to increase rates in Hillsdale, Erie, and Port Byron.

April 14: Hearing at Springfield on complaint of the Calhoun Telephone Co. against the Calhoun Farmers Co-operative Telephone Co., alleging invasion of territory in vicinity of Hardin in making connections and furnishing telephone service to certain subscribers.

April 14: Hearing at Monmouth on application of the Smithshire Telephone Co. for authority to issue $3,000 of its common capital stock; also for approval of purchase of telephone property at Smithshire by the Smithshire Telephone Co., a corporation and sale by Smithshire Telephone Co., a partnership.

KANSAS.

April 1: The Southwestern Bell Telephone & Telegraph Co. authorized to charge $1.25 a month for the using of its Boling lines; $1.50 with the Leavenworth city connection for residents; and $1.75 for business places on the exchange.

LOUISIANA.

April 1: The commission granted a rehearing in the rate case of the Cumberland Telephone & Telegraph Co. covering a period of four months.

MINNESOTA.

April 8: The Kensington Telephone Co., of Kensington; the Farmers Telephone Co., of Donaldson; the Lowry Telephone Co., of Lowrey and Farwell; the Farmers Two Rivers Rural Telephone Co., of Lancaster and Bronson; the Chokio Telephone Co., of Chokio; the J. O. Solie Telephone Co. of Fountain; the Hendrum Telephone Co., of Hendrum; the Deuel County Telephone Co., of Hendricks; and the Comfrey Rural Telephone Co., of Comfrey, authorized to increase rates.

April 9: The Oronoco Telephone Co., of Oronoco, authorized to increase its local and rural rates.

April 22: Hearing at Lake Park on application of the Lake Park Telephone Co. for authority to increase its local and rural rates in Lake Park.

MISSOURI.

March 22: Supplemental order issued suspending until September 30 proposed advances in rates for the Farmers Telephone Co. of Harrison County for its Ridgeway, Gilman City, Edinburg, Brimson, Bridgeport, and Betnany exchanges and the Jamesport Telephone Exchange for its Jamesport exchange.

March 22: Supplemental order issued suspending until September 28 proposed advance in rates for the Meadville Telephone Exchange, of Meadville.

April 1: Supplemental order issued amending order issued March 30, 1921, which granted increased rates to the Citizens Telephone Co., of Higginsville, Mayview, and Corder, fixing the effective date of the increase as April 10.

April 5: Supplemental order issued suspending until October 14 proposed advance in rates for the Downing Telephone Co., of Downing.

NEBRASKA.

April 4: Hearing on the application of the Bertrand Telephone Co. for an increase in rates set for May 12, at Bertrand.

April 4: Application of the Farmers' Telephone Co., of Avoca, for an increase in rates found reasonable and order issued granting them.

April 5: In the matter of the complaint of the Tuckerville Telephone Co. against the Oconto Telephone Co. with respect to service; commission finds that the company is in need of a new switchboard and orders it purchased, conditioned upon the payment by numerous farmer patrons of service fees, none of which had been paid for 1920.

April 6: Complaint filed by H. L. Keefe against Walthill exchange alleging inability to secure a proper standard of service.

April 6: Application filed by the Upland Telephone Co., by R. E. Swan, secretary, asking for permission to issue 100 per cent stock dividend of $6,040 and to sell $4,000 of new stock for the purpose of paying indebtedness of company, which claims total assets of $23,361.

April 7: Complaint filed by Running Water Telephone Co. against Hay Springs Telephone Co., alleging company does not collect fees for serving 12 patrons through knife switch attached to line of complainant company.

April 8: Complaint filed by C. Meyers against Loup Valley Telephone Co. averring that service was discontinued upon his refusal to sign a contract presented to him.

NEW YORK.

March 31: Application filed by the Mountain Home Telephone Co., of Plattsburg, for authority to acquire the outstanding capital stock of the Port Henry Telephone Co.; also for authority to issue $54,800 in general mortgage bonds.

April 11: Hearing at New York City on petition of the New York Telephone Co. in respect to increasing rates, tolls, and rentals in New York City.

NORTH DAKOTA.

April: Application filed by the Buffalo Telephone Co. for authority to increase rates in Buffalo.

OREGON.

April 5: Application of the Deer Island Mutual Telephone Co., of Deer Island, for authority to increase rates dismissed, the commission finding that the company is purely a mutual association organized solely for the purpose of furnishing service to its own members.

PENNSYLVANIA.

March 25: Notice of increased telephone rates filed by the Eastern Crawford Telephone Co., to become effective May 1.

April 2: The Centerville Rural Telephone Co., of Cumberland County and the Economy Telephone Co., of Meyersdale, have filed notices of advances in rates.

RHODE ISLAND.

April 1: New schedule of rates filed by the Providence Telephone Co., providing for a reduction in station to station rates, a charge of $1 for changing equipment, coils, etc., and a charge of $1.50 instead of $3 for transferring the telephone from one person to another in private branch exchange systems.

SOUTH CAROLINA.

March 26: The Southern Bell Telephone & Telegraph Co. authorized to increase rates 20.72 per cent, effective April 1.

SOUTH DAKOTA.

April 1: The Dakota Central Telephone Co. authorized to charge $1.50 for rural party line service in the Watertown exchange area.

April 7: The White Rock Rural Telephone Co., of Rosholt, authorized to increase its local and rural rates.

UTAH.

March 29: Rates established by Postmaster-General Burleson, with the exception of measured service rates, now in effect on the Utah portion of the Mountain States Telephone & Telegraph Co.'s system, upheld by the commission.

WISCONSIN.

March 28: The Marshfield Telephone Exchange, the Marshfield Rural Telephone Co., and the Lindsey Telephone Co. authorized to charge a toll rate of 10 cents on all local messages passing over the trunk lines between the Marshfield and Lindsey exchange, or the Marshfield Rural company's exchange.

March 31: The Waunakee Telephone Co. authorized to charge $6 per year per subscriber for switching service to the Poynette Telephone Co.

March 31: The West Bend & Trenton Telephone Co., a roadway company serving 21 subscribers, authorized to increase its rural multi-party rates from $12 to $18 per year, subject to a discount of $3 per year for payment in advance. The fair value of the company's property for rate-making purposes was found to be $570.81, which is approximately $27 per station.

March 31: The Beloit Farm Telephone Co., a roadway company serving 508 subscribers in the territory tributary to Beloit, 341 of whom reside in Wisconsin and the balance in Illinois, authorized to charge $2 net per month for rural multi-party service with five or more parties. One to four-party service is $2 net per month, plus the extra switching charge made by the Wisconsin Telephone Co. for switching lines with less than five stations.

March 31: The Washington County Telephone Co., of Schleisingerville, authorized to increase rates.

March 31: The Badger Mutual Telephone Co. authorized to increase rates and ordered to reduce number of subscribers on rural lines within 60 days.

April 6: New schedule of rates approved for the Blue River Telephone Exchange Co. to be established in lieu of rates authorized March 30, 1921.

April 8: The Farmers Independent Telephone Association, of Caroline, authorized to increase rates.

April 13: Hearing at Madison on application of the Adams County Metallic Telephone Co., of Friendship, for authority to increase its switching rates and revise toll schedules. U-2456.

April 15: Hearing at Madison on application of the Edgar Local Telephone Co., of Edgar, for authority to increase rates. U-2457.

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Enables the listener to hear with ease no matter how noisy the office or factory. Indispensable for long distance calls. Leaves both hands free while phoning.

Model A—$2.00
Model B—$3.00

Distributers and Agents wanted.

Sales division
Robt. I. Erlichman
Inc.
Widener Bldg.
Philadelphia, Pa.

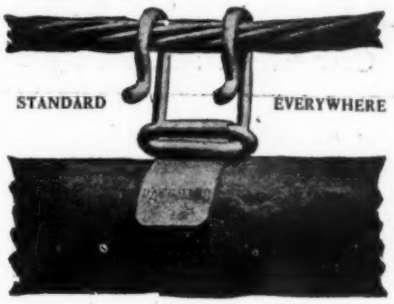
"STEWART" CABLE TESTER

Locates shorts, grounds and crosses to an inch. The only practical tester for locating water trouble.

Write for circular today, and be ready for trouble which is sure to come.

Sent on trial.

STEWART BROTHERS
OTTAWA ILLINOIS



BOSTON CABLE CLIPS

make a secure and permanent installation

because of their incomparable strength and simplicity. In designing the BOSTON we bore in mind the fact that for durability there is nothing like metal. These all metal cable clips have demonstrated the correctness of this principle by the superior service they have rendered under all conditions.

The BOSTON CABLE CLIP is a wonder for simplicity—consists merely of two pieces of wire and a strap of sheet metal. There are no rivets, pins or buttons—consequently, no breakage from these sources.

The BOSTON is more easily and firmly attached by hand than any clip requiring the use of pliers.

It can be applied when the cable is on the ground. It can be detached and used again.

The BOSTON takes a bulldog grip on the cable and stays put under all conditions. Even on long stretches where the dip of the cable is great, these clips will not budge. The hook is so designed that the bearing surface is on two points, allowing the hook to slide easily on the messenger wire without jumping.

BOSTON CABLE CLIPS are fully galvanized to prevent rusting.

A variety of sizes for every need.

Sample and prices on request.

THE CHASE-SHAWMUT CO.

NEWBURYPORT, MASS.

DISTRICT REPRESENTATIVES:
E. M. Scribner, - 549 W. Washington Street, Chicago
Wm. S. Brown Electric Co., 3 West 29th St., New York
H. B. Squires Co., 583 Howard St., San Francisco, Cal.
Engineering Equipment Co., 112 S. 16th St., Philadelphia
H. B. Squires Co., 552 First Avenue, So., Seattle, Wash.
H. C. Moran, - Keystone Building, Pittsburgh, Pa.

NORTHERN ELECTRIC COMPANY, Limited
Montreal Halifax Ottawa Toronto London Winnipeg
Regina Calgary Edmonton Vancouver Victoria

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

From Factory and Salesroom

Conventions: Florida, Jacksonville, April 19; Iowa, Des Moines, April 26-28

Engineering Advertisers' Association of Chicago Holds Meeting.

The first meeting of the Engineering Advertisers' Association, of Chicago, under the presidency of Keith J. Evans, advertising manager of Joseph T. Ryerson & Son, was held April 12, at the Engineers Club, Chicago. The association was fortunate in securing Halbert P. Gillette, who spoke on the subject of "Educational Advertising."

The Engineering Advertisers' Association although only two years old, is rapidly growing and is a large factor in the engineering field. Its active members are advertising and sales managers of nationally known concerns manufacturing engineering products and its associate membership is composed of one representative, each, from trade papers in the engineering and allied fields.

Book Review.

THE THERMIONIC VACUUM TUBE AND ITS APLICATIONS, by H. J. van der Bijl. Published by the McGraw-Hill Book Co., Inc., New York. 391 pages, 6 ins. by 9 ins.; 232 illustrations. Price $5.

In November, 1920, the "Thermionic Vacuum Tube and Its Application," by Dr. H. J. van der Bijl, formerly research physicist of the American Telephone & Telegraph Co. and Western Electric Co., was published.

This book has been so well received by technical men that the supply is almost exhausted and a second edition is being rushed through. It is the first detailed treatise in one volume on the principles of operation of vacuum tubes and the applications of these tubes.

The first chapters are elementary. Chapter IV takes up the physics of the thermionic valve. The influence of gas on the discharge is discussed in chapter V and the rectification of currents by the thermionic valve is described in chapter VI.

The amplifier, its operation and circuits that can be used; the efficient operation of a three-electrode tube as an oscillation generator, the modulation and detection of curents with the thermionic tube and miscellaneous applications of the thermionic tube are clearly and concisely dealt with in the succeeding chapters.

Drawings and photographs simplify the text and add to the attractiveness of the pages. Owing to the ability of thermionic vacuum tubes to perform a great variety of functions, the subjects included in this new volume are of great interest to telephone and radio men.

Office for Centralized Accounting Established in Minneapolis.

It is announced that F. L. Wetch, manager of the Public Accountants Co., of Minneapolis, Minn., has established an office in connection with centralized accounting for both large and small companies in five states—North Dakota, South Dakota, Minnesota, Wisconsin and Iowa.

Mr. Wetch, who has been in the telephone business for over 15 years, is a specialist in telephone accounting.

Showing the Stromberg-Carlson Switchboard in North Dakota.

An exceedingly attractive exhibit at the convention of the North Dakota Telephone Association, held at Fargo, N. D., March 22 to 25 inclusive, was that of the Stromberg-Carlson No. 105 standardized magneto switchboard.

View of Stromberg-Carlson Exhibit at North Dakota Telephone Convention.

Mrs. Abby, wife of the manager of the Farmers & Merchants Telephone Co., at Flaxton, N. D., operated the switchboard, about which she is very enthusiastic, and explained to interested visitors the value of automatically restored supervision and keyboard supervision, together with many other features found in the No. 105.

Statement of Telephony's Ownership.

Statement of the ownership, management, circulation, etc., required by the act of Congress of August 24, 1912, of Telephony, published weekly at Chicago, Ill., for April 1, 1921.

State of Illinois, County of Cook, ss.—Before me, a notary public in and for the state and county aforesaid, personally appeared, S. R. Edwards, who, having been duly sworn according to law, deposes and says that he is the Editor of Telephony, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above, required by the act of August 24, 1912, embodied in section 443, postal laws and regulations, to-wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager, are:

Publisher—Telephony Publishing Corp., 116 S. Michigan Ave., Chicago.

Editor—S. R. Edwards, 116 S. Michigan Ave., Chicago.

Managing editor—S. R. Edwards, 116 S. Michigan Ave., Chicago.

Business manager—H. D. Fargo, 116 S. Michigan Ave., Chicago.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)—H. D. Fargo, 116 S. Michigan Ave., Chicago; J. R. Hastie, 116 S. Michigan Ave., Chicago; S. R. Edwards, 116 S. Michigan Ave., Chicago.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: H. D. Fargo, 116 S. Michigan Ave., Chicago; J. R. Hastie, 116 S. Michigan Ave., Chicago; S. R. Edwards, 116 S. Michigan Ave., Chicago.

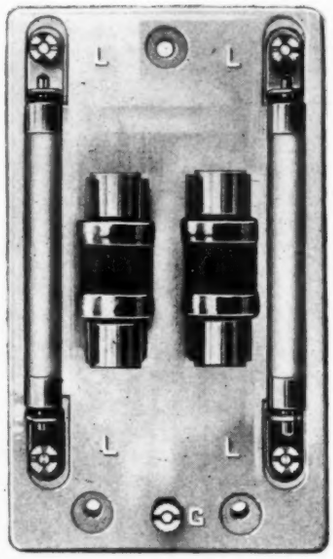
4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner, and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

S. R. EDWARDS.
Editor.

Sworn to and subscribed before me this 1st day of April, 1921.

(Seal.) E. V. CROSS.

(My commission expires Oct. 23, 1924.)



40-A Arrester

BRACH
VACUUM ARRESTERS

The Final Solution of your Protection Problem

The vacuum principle has proved so completely successful for telephone protection that its universal adoption is a certainty.

BRACH VACUUM ARRESTERS, made especially for telephone purposes, represent the highest development of this principle. They eliminate noisy and grounded lines as well as high maintenance costs.

During the coming months we shall tell you in these pages why BRACH VACUUM ARRESTERS are your best protection. Read these announcements weekly or write us for our literature.

L. S. BRACH MFG. CO.
NEWARK - NEW JERSEY

CEDAR POLES

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Plain or Butt Treated
THE VALENTINE-CLARK COMPANY,
SPOKANE, WASH.
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"NAUGLE" POLES
Plain or Butt Treated. Largest Stocks.
READY FOR IMMEDIATE SHIPMENT
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Main Office: 50 E. Madison St. CHICAGO

NORTHERN **CEDAR POLES** WESTERN
BUTT-TREATING GUARANTEED GRADES
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CEDAR POLES
A FULL ASSORTMENT OF SIZES
PROMPT SHIPMENTS ASSURED
T. M. PARTRIDGE LUMBER COMPANY
Lumber Exchange MINNEAPOLIS

To insure delivery on time order your poles as early as possible.

Note Protection at Corners

Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds.

4 Sizes Pat. Nov. 1900

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Blake Signal & Mfg. Co.
BOSTON, MASS.

White Cedar Poles
A SPECIALTY
Yards in Minnesota, Ontario, and Manitoba
Prompt and Satisfactory Service
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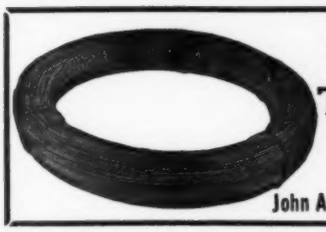

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Double Galvanized
TELEPHONE WIRE
E. B. B., B. B. and Steel Grades
John A. Roebling's Sons Co., Trenton, N. J.

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

Condensed Telephone News

Officers of Companies Are Urgently Requested to Forward to Us Promptly All Financial and Other Statements as Soon as Issued and Any Items Relating to Construction, Rebuilding, or Changes in Their Plants and Systems

New Telephone Companies and Incorporations.

DOVER, DEL.—The Gulf States Telephone Co. has been organized with $250,000 capital stock. The company's Texas headquarters are at Tyler, Texas.

SARDIS, KY.—The Sardis & Silvia Telephone Co. has been incorporated with $225 capital stock by T. W. Todd, Robert Hudson, and Frank Rogers.

WEST CONCORD, MINN.—The United Telephone Co. has been organized with a capital stock of $35,000 for the purpose of operating telephone systems and exchanges and dealing in electrical supplies. Its incorporators and officers are C. D. Simpson, president; J. J. Cain, vice-president; and E. C. Kaiser, secretary-treasurer, all of West Concord.

BURNSVILLE, MISS.—The Burnsville Telephone Co. has been incorporated by John Floyd, Dewey Blakney, and J. F. Woodruff.

ASHBORO, N. C.—The Randolph Telephone Co. has been organized, being a consolidation of the Ashboro Telephone Co. and the Riverside Telephone Co., with $20,000 capital stock. K. D. Cox, of Ramseur is the manager. Plans are being made for improving and installing additional lines.

MEEKER, OKLA.—The Meeker Rural Mutual Telephone Co. has been incorporated by D. M. Fuller, W. C. Fair, of Meeker; and J. A. McCown, of McLoud.

TABOR, S. DAK.—The Elm Grove Telephone Co. has been organized with $1,000 capital stock by Edward Olsen, Adolf Mauksch, Max L. Miller and Mads Smith, all of Tabor.

DAVILLA, TEXAS.—The Davilla Telephone Co. has been incorporated with $2,080 capital stock. Its incorporators are W. M. Farmer, W. N. Malone, and B. H. Keith.

Construction.

TAMPA, FLA.—The Peninsular Telephone Co. contemplates expending $250,000 in extensions and improvements during 1921. The company has purchased the Highland Telephone Co., and will install two additional toll lines between Tampa and Lukeland and one from Lukeland to Mulberry.

IONE, CALIF.—Work is now under way by the Pacific Telephone & Telegraph Co. in installing a modern and complete telephone exchange in Ione.

Shoals, Ind.—Stephen Isom, owner of the Commonwealth Telephone Co., has purchased a new exchange building and is making preparations to rebuild the telephone plant and to place all wires underground. The new building was erected for a combined business house and residence, and is said to be equipped with all modern conveniences.

GENESEO, KANS.—A new brick telephone building, bungalow style, is to be constructed by the Geneseo Telephone Co. The company is also making other improvements, having substituted underground cables for overhead wires.

BRISTOW, OKLA.—Approximately $30,000 is contemplated being expended by the Southwestern Bell Telephone Co. in improvements and extensions to its system.

ROCK HILL, S. C.—Plans are being made by the Rock Hill Telephone Co. to generally improve its system and to lay conduits for underground cables.

Financial.

CALEDONIA, OHIO—The Caledonia Telephone Co. has increased its capital stock from $25,000 to $60,000. The company's incorporators are C. E. Kelly, John Pommert, L. C. Donnenwirth, T. J. Bitman and R. L. Highley.

EDINBURG, VA.—The Farmers Mutual Telephone Co., of which N. F. Snarr is secretary, has increased its capital stock from $15,000 to $25,000.

HARRISONBURG, VA.—The Farmers Mutual Telephone Co. has increased its capital stock from $15,000 to $25,000.

Elections.

EVANSVILLE, IND.—At the annual meeting of the stockholders of the Southern Indiana Telephone Co. held at McCutchanville recently, all the directors were re-elected as follows: B. H. Kippel, Powell Young, Ernest Sein, Charles Bomgart, Henry Gerhart, George Boight, Thomas Jarvis, Ed Strimling, George Herr, John Pilgrim, and A. McCutchan.

DETROIT, MICH.—The board of directors of the Michigan State Telephone Co. recently re-elected the following officers: President, F. C. Kuhn, of Detroit; vice-president, Dudley E. Waters, of Grand Rapids; vice-president and general manager, G. M. Welch, of Detroit; secretary-treasurer, W. I. Mizner, of Detroit; and general auditor, H. J. Booth, of Detroit.

Duplain, Mich.—The Ovid Mutual Telephone Co. held its annual meeting recently and elected J. H. Aldrich, president; James Brown, vice-president; and Sam Gleason, secretary-treasurer.

GRAND RAPIDS, MICH.—Stockholders of the Citizens Telephone Co., at annual meeting held recently, re-elected directors as follows: William H. Anderson, Frank E. Church, Herbert W. Curtis, Theron H. Goodspeed, R. D. Graham, Claude T. Hamilton, Clay H. Hollister, R. W. Irwin, John B. Martin, Willard K. Spencer, C. E. Tarte, and Victor M. Tuthill.

Shepardsville, Mich.—The newly-elected directors of the Ovid Mutual Telephone Co. are: S. B. Gleason, J. H. Aldrich, and Robert Hazle, for a term of three years; W. H. Winfield, E. Parker, and Russell Ash, for two years; Harvey Sobers and James Brown for one year.

Redwood Falls, Minn.—Stockholders of the Redwood Falls Electric Telephone Co. held their annual meeting recently and elected the following directors to serve for the ensuing year: A. R. A. Laudon, G. A. Jaehning, T. H. Inglis, R. Stensvad, A. D. McRae, C. F. Galles, and R. A. Cooper. The officers elected are: Rud Stensvad, president; A. D. McRae, secretary; and R. A. Cooper, treasurer.

Skidmore, Mo.—The annual election of officers of the Consolidated Telephone Co. was held recently, and the following board of directors was elected: Geo. Patterson, Geo. McDaniels, James Bagby, William Taylor, Frank Taylor, Wm. Blackney, and William Barber. John McMahon was elected secretary to succeed R. A. Walker, and Frank Goslee was re-elected treasurer.

Bryan, Ohio—The annual meeting of the stockholders of the Williams County Telephone Co. was held recently and the following directors elected for the ensuing three years: D. H. Clauden, C. L. Newcomer, Will Morrison, and O. S. Eaton. The board of directors then organized by electing O. S. Eason, president; C. L. Newcomer, vice-president; C. S. Roe, secretary; and E. B. Willett, treasurer.

Tiffin, Ohio—Directors of the Tiffin Consolidated Telephone Co. elected officers recently as follows: A. A. Cunningham, president; W. H. Koldow, vice-president; A. J. Mellen, secretary; and J. J. Fleck, treasurer. At the annual meeting of stockholders, the following directors were re-elected: A. A. Cunningham, W. H. Kildow, J. J. Fleck, W. D. Crawford, manager; J. C. Royer, E. A. Reed, W. G. Palmer, and L. A. Steeg.

Wausau, Nebr.—At the annual meeting of the stockholders of the Wausau Telephone Co. held recently, officers were re-elected as follows: Nathan Heinemann, president; E. B. Thayer, Sr., vice-president; W. W. Albers, treasurer; James Montgomery, secretary; and G. D. Jones, counsel.

Troy, Pa.—At a meeting of the stockholders of the Citizens' Mutual Telephone & Telegraph Co., held recently, the following officers and directors were elected: President, T. F. Hotchkiss, of Mainesburg; treasurer, W. Henry Boughton, of Troy; secretary, Charles N. Greene, of Troy; directors; Cola J. Beach, of Mansfield; Wellon J. Smith, of Millerton; and William Horning, of Columbia X. Roads.

Trezevant, Tenn.—At the annual stockholders' meeting of the Trezevant Telephone Co., held recently, the following officers were elected for the ensuing year: President, W. F. Smith; vice-president, R. L. Bryant; manager, Dock Foster; and secretary-treasurer, A. D. Argo. In addition to the officers, the following members were selected to serve with the officials in composing the board of directors: H. L. Weatherford, W. R. Cloyd, T. E. Ethridge, J. E. Bryant, W. H. Hames, and A. R. Bryant.

Denmark, Wis.—The Brown County Telephone Co. held its annual meeting recently and re-elected all its old officers and directors.

Miscellaneous.

Carlisle, Ind.—Otto L. Finch, of Carlisle, has purchased the controlling interest in the Carlisle Telephone Co. and has taken over the management of the system. The following new directors have been elected: Otto L. Finch, Thomas I. Davidson, and Charles W. Lisman. Mr. Davidson was elected president of the company, Mr. Lisman secretary, and Mr. Finch treasurer and general manager. A new switchboard will be installed at an early date.

Oxford Junction, Iowa—The Oxford Junction Telephone Co. has been sold to Ben Hall, of Wilton.